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TECHNOLOGIES TO COMBAT WEAPONS OF MASS DESTRUCTION

HEARING

BEFORE THE

SUBCOMMITTEE ON EMERGING THREATS AND CAPABILITIES

OF THE

COMMITTEE ON ARMED SERVICES
UNITED STATES SENATE

ONE HUNDRED TENTH CONGRESS

SECOND SESSION

MARCH 12, 2008

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MARCH 12, 2008

TECHNOLOGIES TO COMBAT WEAPONS OF MASS DESTRUCTION

WEDNESDAY, MARCH 12, 2008

U.S. SENATE
SUBCOMMITTEE ON EMERGING
THREATS AND CAPABILITIES,
COMMITTEE ON ARMED SERVICES,
Washington, DC.

The subcommittee met, pursuant to notice, at 2:41 p.m. in room SD–106, Dirksen Senate Office Building, Senator Jack Reed (chairman of the subcommittee) presiding.

Committee members present: Senators Reed, Warner, and Dole.

Majority staff members present: Madelyn R. Creedon, counsel; Richard W. Fieldhouse, professional staff member; and Arun A. Seraphin, professional staff member.

Minority staff members present: Lynn F. Rusten, professional staff member; Robert M. Soofer, professional staff member; Kristine L. Svinicki, professional staff member; and Diana G. Tabler, professional staff member.

Staff assistants present: Kevin A. Cronin, Jessica L. Kingston, and Brian F. Sebold.

Committee members' assistants present: Elizabeth King, assistant to Senator Reed; Andrew R. Vanlandingham, assistant to Senator Ben Nelson; Nadia Naviwala, assistant to Senator Webb; Jennifer Cave, assistant to Senator Warner; Mark J. Winter, assistant to Senator Collins; and Lindsey Neas, assistant to Senator Dole.

OPENING STATEMENT OF SENATOR JACK REED, CHAIRMAN

Senator REED. Let me call the hearing to order. Good afternoon. The subcommittee meets today to hear testimony on technology to combat weapons of mass destruction (WMD). We are fortunate to have started with a demonstration of a number of technologies being developed or fielded for our military and other government agencies, including some technologies that are used here in the Homeland to protect our population.

I want to thank all of the organizations that have brought these technologies to us today, including the Defense Threat Reduction Agency (DTRA), the Joint Program Executive Office for Chemical and Biological Defense (JPEO/CBD), the Defense Advanced Research Projects Agency (DARPA), the Air Force, the Navy, and a number of Department of Energy (DOE) laboratories.

I also want to particularly thank Jessica Kingston of our committee staff for organizing this technology demonstration. Jessica, you did a superb job. Thank you very, very much.

This technology demonstration is a great opportunity for us to see firsthand what you have developed and put into the hands of those who we ask to protect us and to detect, decontaminate, or defeat threats from chemical, biological, radiological, nuclear, or high-yield explosive weapons and materials.

We are pleased today to have three experts on technology to combat WMD. Dr. James Tegnelia is the Director of DTRA, which is the Department of Defense's (DOD) agency with the lead for protection against and reducing threats from WMD.

Dr. Tegnelia also serves as the Director of the U.S. Strategic Command (STRATCOM) Center for Combating WMD. His agency has expertise and responsibility across the spectrum of all WMD and supports the combatant commands and other governmental agencies and their operational needs relating to these weapons.

Major General Stephen Reeves is the JPEO/CBD at DOD. His responsibilities include the research, development, and acquisition of all chemical and biological defense equipment and medical countermeasures for all of the United States military.

It is one of the less well-known success stories that DOD has a single joint program for all chemical and biological defense efforts. His organization cooperates extensively with both DTRA and with DARPA, both of which conduct critical research and development (R&D) on chemical and biological defense technologies.

Dr. Jan Cerveny is the Assistant Deputy Administrator for Nonproliferation Research and Engineering at the National Nuclear Security Administration (NNSA) at DOE. The NNSA is our Nation's expert agency on nuclear weapons and related technologies. The labs that this agency works with are among the exhibitors at today's tech demo. They conduct R&D on the technologies for detecting radiation, and detecting, monitoring, and analyzing nuclear weapons activity of other nations.

We hope to learn today about the challenges you all face in trying to develop these technologies, the successes that you have had, and how this technology fits into our numerous efforts to combat WMD. We thank you and all of those who you work with for your dedicated efforts to keep our Nation and our military forces safe from these dangerous threats.

We appreciate that your agencies also had a role in the response to and decontamination of the Senate office buildings after the anthrax attacks of October 2001. We look forward to hearing your testimony.

Now let me turn to Senator Dole for her comments. Senator Dole, please.

STATEMENT OF SENATOR ELIZABETH DOLE

Senator DOLE. Thank you very much, Mr. Chairman. I certainly join Senator Reed in welcoming our witnesses, and I want to thank each of you for your efforts in working to secure our Nation and our deployed forces against the threats posed by chemical, biological, and nuclear weapons.

I would also like to thank the participants and presenters who have gone to considerable effort to bring us the technology demonstrations we have reviewed this afternoon.

Throughout our history, when this Nation is faced with threats to our security and to our Homeland, we have called upon our scientists and engineers to rise to the challenge of developing the technologies and innovations needed to help defeat those threats and to keep us safe.

The technologies demonstrated here today are impressive, indeed, examples of American innovation and the progress we are making. The threat of WMD getting into the hands of terrorists remains the preeminent threat to our country and our allies. Today's hearing will focus on the R&D efforts of the DOD and DOE to develop technologies to identify, eliminate, interdict, defeat, or destroy WMD and to mitigate the consequences of a WMD incident.

I look forward to the testimony of our witnesses regarding R&D programs under their purview to include the Nation's and their respective departments' requirements in these areas. How well their departments are doing to identify, prioritize, and meet those requirements. How they are coordinating their R&D efforts with those of other Federal agencies, as well as other public and private organizations.

I am also interested to know whether the fiscal year 2009 and Future Years Defense Program budget reflects sufficient priority, resources, and authorities for these important technology R&D programs.

Dr. Tegnelia, wearing two hats and the responsibilities that he has in both of these positions, is responsible for developing, integrating, and providing capabilities to reduce and counter the threat to the United States and its allies posed by WMD. We welcome your testimony of how DTRA integrates and coordinates these disparate efforts to meet the requirements identified by the Department for combating WMD.

General Reeves is responsible for the research, development, and acquisition of all chemical and biological defense equipment and medical countermeasures for the armed services and for integrating and coordinating all DOD efforts to develop and field chemical, biological, radiological, and nuclear defense equipment as well as medical countermeasures for the warfighter.

We welcome your testimony on how DOD establishes requirements in this area, how you apportion resources to meet those requirements, how efficiently DOD transitions technology into fielded capabilities, and to what extent these protective capabilities are provided to the Active-Duty, Reserve, and National Guard components of the armed services.

Dr. Cerveny is responsible for R&D to support nonproliferation requirements, using the unique facilities and scientific skills of the DOE national laboratories in partnership with industry and academia. The core mission of her organization is to develop the next generation of nuclear nonproliferation sensors and detection capabilities.

We welcome your testimony on how you prioritize technology investment and how you coordinate and integrate these R&D programs within DOE and with other Federal agencies, including DOD and the Department of Homeland Security (DHS).

Let me again join our Chairman in thanking all of our witnesses for their service and certainly for appearing here today and giving us your testimony.

Senator REED. Thank you very much, Senator Dole, not only for your statement, but also for your great collaborative efforts on the subcommittee. We enjoy very much—I do—your support and your participation.

Senator DOLE. Thank you.

Senator REED. The witnesses, your written statements will be made part of the record. So feel free to summarize, to cut to the point of most importance. We will recognize Dr. Tegnelia first. Dr. Tegnelia?

STATEMENT OF DR. JAMES A. TEGNELIA, DIRECTOR, DEFENSE THREAT REDUCTION AGENCY; AND DIRECTOR, U.S. STRATEGIC COMMAND CENTER FOR COMBATING WEAPONS OF MASS DESTRUCTION

Dr. TEGNELIA. Thank you, Mr. Chairman. Senator Reed and Senator Dole, thank you very much for taking this opportunity to give all of our engineers and scientists the opportunity to display to you some of the important work that they are doing. We appreciate this opportunity.

I also would like to tell you that I appreciate the opportunity to appear before you on this panel with two associates, General Steve Reeves, who our agency works with on a continuing basis with regard to the chemical and biological weapons program, and also Dr. Jan Cerveny of the DOE.

DTRA has the responsibility for being the DOD executor of the Nunn-Lugar program, and we work with the DOE on nuclear matters associated with the Nunn-Lugar program. So it is a pleasure to be on the same panel with them this morning.

Sir, as you indicated, we have submitted our statement for the record. That statement outlines six challenges that DTRA is responsible for addressing. In order to be brief, I would like to summarize, if I could, just two of those challenges.

The first one is the subject of loose nuclear weapons and what we would do about that, and the second one, if I don't take too much time on that subject, is to just summarize advancing biological sciences and their impact on WMD.

Those are the two topics that I would like to talk——

Senator REED. I don't mean to artificially cut you off either. Take as much time as you like, but you don't have to just read the statement.

Dr. TEGNELIA. Yes, sir. I didn't intend to read, sir.

Let me start with the loose nuclear weapons. As I indicated at the start, one of the significant purposes of the Nunn-Lugar program is to secure nuclear weapons, secure nuclear material, and destroy strategic nuclear weapons delivery systems. We think we have, over the 15 years, a pretty good track record with regard to that.

The subject of loose nuclear weapons begins if some of those safeguards should happen to fail and a nuclear weapon or nuclear material ends up in the hands of a terrorist group with the intent to

detonate a device either in a city in the United States or the city of an allied government. That is the topic of loose nuclear weapons.

Now we are very active in that program and, in fact, have a capability today to deal with loose nuclear weapons. It is the capability that we have today and the ability to improve that capability, which serves as the challenge to the R&D activity.

The fundamental element associated with finding loose nuclear weapons today is the fact that we either must have precise intelligence information as to the location of that device, or it has to pass through a portal on a foreign border or in a harbor before that device could enter into the United States. We and the DOE work on those portals, and we have them deployed outside of the United States to try to find those nuclear devices.

One of the significant R&D challenges is to increase the range from a few tens of meters to hundreds of meters and kilometers. So that we no longer are limited by the fact that we have to have precise intelligence information or that they must pass through a portal in order to be able to find it. That is probably the most challenging R&D task that we have today.

Now we work that problem with the DOE, with the national laboratories. You may be familiar with the Global Initiative on Combating Nuclear Terrorism, which President Bush and President Putin started 2 years ago. One of the elements of that global initiative is to do cooperative international research associated with this detection of nuclear material and detection of nuclear weapons problem, and we work cooperatively with several other participants in the global initiative on nuclear detection.

In the event that you find a weapon, the next important problem is how do you demilitarize it or disarm it? What we would like to do and are working on is research associated with how to disarm the weapon at a distance, at stand-off ranges. Today, you have to be in close proximity to the weapon.

Second, to be able to disarm it in a manner that doesn't require you to have precise information having to do with the construction of the weapon. That represents another significant challenge to us, and we are in the process of working that activity as well.

Lord forbid, if both of those fail and a nuclear weapon ends up, or nuclear material ends up in a city in the United States or in a city of an allied country and there is a detonation, then two significant problems occur to the first responders. The first problem is the subject of attribution. How do we know who did it?

That is an important question because of three points. The first one is if we know how to attribute, then that serves as a deterrent in its own right from people doing this kind of an action. The second thing is it is very important for us to make sure that we can attribute quickly enough that we can stop a second or subsequent event from occurring. Then, finally, should the decision be made for retribution, then the information that you get from attribution is critical in making the decisions to do that.

Now you saw several displays around the room today on the subject of attribution. We are just now at the point where the R&D is beginning to produce a product which we can field, the first nuclear forensics capability for the subject of attribution. The biggest

challenge that we have now is putting that kind of a capability into the field.

The research challenge is to be able to reduce the time to do that analysis and also to make sure that we are getting good information from the analysis that we are doing. I will indicate that Dr. Cerveny's operation in the DOE, the DHS, and the Federal Bureau of Investigation (FBI) are very active in developing the capability for attribution.

The last topic that one would address with loose nuclear weapons is the subject of consequence management. The DOD has done several exercises with regard to radioactive dispersal devices (RDDs) or dirty bombs, and improvised nuclear devices (IND) in Hawaii and in Indianapolis.

We also have been part of a series of interagency exercises called TOPOFF associated with RDDs. As I mentioned on the Global Initiative for Combating Nuclear Terrorism, we are now doing international activities associated with consequence management.

What we found in those exercises is that INDs and RDDs represent a very large spectrum of consequences, from few deaths and minimal economic disruption to large numbers of deaths and significant economic disruption on the part of both INDs and RDDs. I believe our local responders and the State units, assisted by the Federal Government, are capable of handling the lower end of this spectrum.

Our exercises show that the local responders are capable of dealing with this kind of an activity. It is when you get closer to the higher end of the spectrum, where there are significant yields and significant numbers of deaths, that the operational and research challenges are in the extreme. That represents a significant research challenge to us.

You saw some activities here associated with decontamination. You saw some activities associated with medical therapeutics for radiation poisoning. Finally, you saw modeling that was going on in this room to help the first responders and knowing the very difficult environment that they are going to be working in.

Sir, ma'am, that completes my comments with regard to loose nuclear weapons. I would just ask you for a time check. Do I have a few minutes to talk about biological sciences?

Senator REED. You are still making sense. Go on. [Laughter.]

Dr. TEGNELIA. Thank you, sir. That is the check.

Let me spend just a few minutes on the biological thing, as I don't want to take time away from the other members of the panel.

Biological sciences today represents the most advancing scientific discipline worldwide. The fact is we are probably in a situation which is analogous to the dawning of the atomic age in the 1930s before somebody had really demonstrated or designed such a weapon. So the fact is that we are in the process of trying to develop a toolkit in order to be able to be prepared for the advancing of biological sciences and the fact that almost every advancing science has a negative side to it, even though it has been beneficial to mankind.

I believe that our significant challenge is being prepared for, having the toolkit available for advancing biological sciences, and I just want to summarize two things very briefly.

The first thing is you are probably aware of the fact that very important research is being done on the part of the Nunn-Lugar program. It is creating a series of central research laboratories in Central Asia, where they are collecting rare pathogens, centralizing them, and categorizing them. Those pathogens are challenging us to develop therapeutics that respond to those pathogens should an entity be able to isolate them and create a biological weapon from a rare species.

So that is the first problem. How do you detect the presence of it? How do you understand the pathogens you are going to be dealing with, and how do you prepare for those?

Then there is a second program to respond to those diseases should they become present in our forces or to civil society. Now, General Reeves is going to talk to a program called the Transformational Medical Technology Initiative (TMTI). I will just summarize it by saying that DTRA works with General Reeves's operation to create medical therapeutics that can respond to this advancing biological sciences activity, and also produce therapeutics rapidly and safely in order to be able to respond quickly to the presentation of a new biological weapon or a rare strain of a particular disease.

Sir, ma'am, with that in mind, I would like to summarize and just tell you that I appreciate the opportunity to be on this panel today and represent the effort of DTRA. This is our 10th anniversary. I think it is a witness to the agency's founding fathers' foresight that they were concerned about WMD in the hands of terrorists long before September 11 occurred. I think you can see that there are dedicated people that are concerned about that.

I also, as you mentioned, in my second hat work with STRATCOM. STRATCOM is the element of the combatant commanders who are responsible for making this capability available to the combatant commanders to help combat WMD. General Chilton, who is the Commander of STRATCOM, is an asset to us producing what are highly expensive, and, therefore, scarce units, getting the concept of operations prepared for those units and getting them out into the field and exercised in order to be prepared for this advance of WMD.

So, again, I thank you very much, both for your participation with our displays and for your attention this afternoon.

[The prepared statement of Dr. Tegnelia follows:]

PREPARED STATEMENT BY DR. JAMES TEGNELIA

INTRODUCTION

Mr. Chairman and members of the subcommittee, it is an honor to be here today to address the technology being developed by the Defense Threat Reduction Agency (DTRA) to combat the threat of Weapons of Mass Destruction (WMD). This year, we in DTRA are celebrating the agency's 10th anniversary. DTRA was created in 1998 to consolidate into a single agency Department of Defense (DOD) elements that had a role in responding to threats posed by WMD. Three overarching national imperatives drove that decision: countering terrorism, sustaining the Nation's nuclear deterrent, and strengthening the Department's WMD nonproliferation, counterproliferation and consequence management capabilities. Ten years later, events demonstrate these imperatives are even more demanding and critical.

I am pleased to report that, in partnership with other U.S. Government (USG) organizations, industry, academia, nongovernmental organizations, and allies and friendly nations, DTRA has expanded the Nation's ability to reduce and, where pos-

sible, eliminate or minimize the threats posed by traditional chemical, biological, radiological, nuclear, and large-scale conventional explosive (CBRNE) weapons.

This progress could not have occurred without the strong support of Congress, and I wish to thank this committee for your approval of our budget request and of the legal authorities we have sought over the years. I am particularly appreciative of your approval of the full DTRA fiscal year 2008 budget request, which represented the most significant change in the agency since its establishment. Your extension of and revisions to the Counterproliferation Program Review Committee (CPRC) statute last year will also strengthen the interagency partnerships that are essential to focusing the full national capability against WMD threats.

My remarks today focus on the progress we have made in developing advanced technologies for the Combating WMD (CWMD) mission. I will address our Research, Development, Test and Evaluation (RDT&E) projects in the context of the broader DTRA CWMD mission, which also includes our Combat Support Agency, other operational mission support, and Nunn-Lugar Cooperative Threat Reduction (CTR) Program responsibilities. I will begin with a review of CWMD mission accomplishments and describe the agency today. My discussion of our nuclear-related technology will take place in the context of a "loose nuclear weapon;" that is, a nuclear weapon in terrorist hands with its ultimate target being a city in America. I will tie that discussion to the items that DTRA has displayed in the back of this room as part of the technology demonstration. I will conclude with a description of the future for DTRA.

COMBATING WMD MISSION ACCOMPLISHMENTS

DTRA was an organization ahead of its time when it was created because today's comprehensively defined and structured CWMD mission did not yet exist. The idea of consolidating a loose confederation of entities that worked in the WMD arena—the Defense Special Weapons Agency, the On-Site Inspection Agency, the Defense Technology Security Administration (DTSA), and the CTR Program Office in the Office of the Secretary of Defense (OSD)—was something quite new. At the time of its establishment, the agency was also designated as a Combat Support Agency and charged with expanding the level of WMD-related support being provided to the combatant commanders (COCOMs). The new agency was also assigned responsibility for executing the science and technology (S&T) portion of the Chemical/Biological Defense Program (CBDP) and was given responsibility for funds management of all CBDP activities. An important new feature of DTRA was the Advanced Systems and Concepts Office, charged with looking at the toughest questions and issues related to current and over-the-horizon WMD threats, and encouraging new thinking about how we respond to these threats.

Despite ambiguity on what it meant to "reduce the threat" and in the absence of a comprehensive high level guiding strategy that linked nonproliferation, counterproliferation, and consequence management with the deterrence missions of the COCOMS, the new agency came together and executed its combined responsibilities with greater efficiency. Over time, changes were made to the original concept for DTRA. The most notable was an early decision by OSD and Congress that the broad technology security mission of DTSA more properly resided in the Office of the Under Secretary of Defense for Policy.

As the Nation came to better understand the nature of the emerging WMD threat, particularly the attractiveness of CBRNE weapons to terrorists, the full potential of DTRA became clearer to all. In addition to executing RDT&E programs and providing operational support, DTRA helped shape the development of CWMD policy, strategy, and operational concepts. Within a few years of establishment, DTRA was widely regarded across the department and among many other USG organizations as the "go to" agency on WMD matters.

A defining moment in the agency's history occurred in December 2002 with the publication of the National Strategy to Combat WMD. This strategy provides the framework of three conceptual pillars—WMD nonproliferation, counterproliferation, and consequence management—that defined the CWMD mission. Subsequent strategy documents such as the National Military Strategy to Combat WMD (February 2006) provided more substance to the overarching national strategy. Recent DOD direction, including the 2006 Quadrennial Review and biennial planning guidance, has increasingly emphasized the need for expanded nonproliferation capabilities such as "security cooperation and partner activities" and "threat reduction cooperation" that support COCOM "Phase 0" operations to shape more favorable security environments; better means for locating and tracking WMD and related materials; expanded WMD elimination capabilities; improved strike capabilities against hard

and deeply buried targets and far more effective nuclear detection, interdiction, and forensics capabilities.

A second defining moment in DTRA's history was the Secretary of Defense's decision in January 2005 to designate the Commander, U.S. Strategic Command (CDRUSSTRATCOM) as the lead combatant command for the integration and synchronization of DOD CWMD efforts in support of USG objectives. Shortly afterwards, the CDRUSSTRATCOM established the Strategic Command Center for Combating WMD (SCC–WMD) to integrate and synchronize DOD efforts to combat WMD. The Center is working to develop and maintain global situational awareness of WMD activities, advocate for CWMD capabilities, and to assist with CWMD-related planning, while shifting emphasis away from DOD-centric approaches toward interagency solutions.

Because DTRA and its predecessor organizations had a long history of providing technical and operational support to Strategic Command (STRATCOM) nuclear mission, and in recognition of the DTRA responsibility as the Department's Combat Support Agency for providing WMD knowledge, expertise, and capabilities to the COCOMs, the DTRA director was "dual-hatted" as the Director for the SCC–WMD. To better leverage DTRA capabilities and to accelerate the operational stand-up of the SCC–WMD, the Center was co-located with the agency at the new Defense Threat Reduction Center at Fort Belvoir, VA, which opened in November 2005. The SCC–WMD achieved Initial Operating Capability (IOC) on January 26, 2006, and Full Operating Capability in December 2006. Thus, there is now a seamless working relationship between the COCOM responsible for the nuclear deterrent and the integration and synchronization of the CWMD mission and the defense agency with technical and operational expertise in both of these missions.

I emphasize this point because it highlights the value of expanded partnerships and collaborative efforts across the DOD, the USG, the private sector, and partner nations. Defeating the WMD threat will require the sharing of situational awareness and the full mobilization of national and international expertise and capabilities. DTRA's relationship with STRATCOM and the other COCOMs is a point of departure from which new interagency relationships across the USG are being developed. A successful example is the partnership that has developed between DTRA and the Intelligence Community (IC). Since 2002, DTRA and the Defense Intelligence Agency (DIA) have jointly addressed the Hard Target Defeat problem through the DTRA Hard Target Research and Analysis Center (HTRAC) partnership with DIA's Underground Facility Analysis Center to locate, characterize, and assess the options against tunnels and deeply buried bunkers related to WMD production, storage, delivery systems, and command and command and control. This concept of teaming DTRA R&D expertise with DIA's intelligence expertise has proven so successful that we have expanded our partnership to encompass the entire CWMD mission area in the form of the new Counter WMD Analysis Cell.

The private sector—industry, academia, and non-governmental organizations—also offer WMD expertise essential to a national effort. DTRA's predecessor organizations had well-developed ties with non-government partners that have both expanded and deepened over the years. For example, through the University Strategic Partnership, DTRA has formed a close relationship with university consortia led by the University of New Mexico and Penn State that support our S&T projects to create the next generation of national WMD experts.

There is also much to be gained by expanding partnerships with allies and friendly nations. Examples of such partnerships include structured programs such as the CTR Program to programs with wider venues, such as the Proliferation Security Initiative and the Global Initiative to Combat Nuclear Terrorism. We in DTRA believe that there are many opportunities to build and expand regional partnerships and integrate these as appropriate into global efforts. In addition, DTRA is partnering with other nations on technology development in support of force protection, hard and deeply buried target defeat, chemical/biological defense, and nuclear detection.

Another defining moment in the transformation of our CWMD capabilities was the reassessment and revitalization of our research and development program beginning in 2006. Of particular note, we initiated a systems approach to CWMD which provided greater integration between RDT&E projects and Operations and Maintenance (O&M) activities, and focused these efforts on addressing capability gaps. With the support of Congress, we have added a CWMD Basic Research (6.1) Program that leverages the basic research being performed by the Services, DARPA, and others. Congress also supported the establishment of a WMD Defeat Capabilities RDT&E (6.5) program that will increase our ability to directly support the special needs of the warfighters.

DTRA TODAY

DTRA is now a "full service" CWMD organization with programs and activities that span threat anticipation; collaboration with and support to the IC; global WMD situational awareness and information sharing across DOD and the USG; research and development in partnership with other USG organizations, academia, industry, other non-governmental organizations, and allies and friends across the globe; technical and operational "reachback" support for an expanding list of customers; WMD-related planning, exercise support, and subject matter augmentation for the COCOMs; arms control; cooperative threat reduction activities; vulnerability assessments and force protection; support to the DOD nuclear mission; and collaborative training, education, and workforce development to maximize the national wealth of WMD expertise.

We are an organization of over 1,900 civilian and military personnel located primarily at Fort Belvoir, VA, and Kirtland Air Force Base, NM. Several hundred of our military and civilian personnel are assigned to field offices and military commands across the U.S., the Pacific, Asia, and Europe. Civilians make up about 60 percent of our workforce, with the balance being uniformed personnel provided by the Services. We are also assisted by an extensive contractor base.

Our $1.2 billion annual direct appropriation includes RDT&E programs, O&M activities, Former Soviet Union Threat Reduction/Cooperative Threat Reduction (FSUTR/CTR) Program funding, and Procurement accounts. DTRA is also responsible for managing the S&T portion of CBDP, which is about $612 million in the fiscal year 2009 budget request, and serves as the funds manager for the approximately $911 million in the fiscal year 2009 CBDP acquisition program. This means that we manage an annual budget portfolio of about $2.8 billion.

Over the past 2 years, we have been developing the concept of "campaigns"—focused and integrated efforts across the agency and our appropriations accounts designed to focus on specific efforts to expand our CWMD capabilities. In addition to integrating our efforts across the agency, campaigns guide us in supporting departmental and national CWMD goals, direct our current program, and identify capabilities that will be needed in the future. Our campaigns span the entire CWMD mission spectrum and encompass nonproliferation, counterproliferation, and consequence management. Campaigns directly support the eight underlying CWMD military missions identified in the National Military Strategy to Combat WMD: Security Cooperation and Partner Activities, Threat Reduction Cooperation, Interdiction, Elimination, Offensive Operations, Active Defense, Passive Defense, and Consequence Management.

The DTRA campaigns and their recent accomplishments are as follows:

Campaign 1 - Situational Awareness

This campaign seeks to develop and sustain global situational awareness of WMD and to support decisive action. Capabilities being sought include: DTRA CWMD Common Operating Picture; a common intelligence picture of WMD; and expansion of partnerships development within the CWMD community of interest. This campaign also provides continuous direct support to the SCC–WMD. Among the products developed by this campaign and now online are the Situational Awareness CWMD Information Portal that supports a common operating picture, and the Interagency CWMD Database of Responsibilities, Authorities, and Capabilities (INDRAC) that provides the CWMD community of interest a comprehensive and accessible accounting of agency responsibilities, legal authorities, and CWMD capabilities. We also established ties with the Department of Homeland Security (DHS), Center for Disease Control, Department of Health and Human Services (DHHS), and Department of State (DOS) to monitor indications and warnings of biological attacks and pandemic diseases.

Campaign 2 - Control WMD Materials and Systems Worldwide

DTRA develops technologies, produces concepts of operation, executes operations and programs, and fosters international partnerships to prevent the proliferation of WMD or WMD-related capabilities. Its goals are to improve control over WMD; reduce the size and shape of the WMD threat; build partner capacity to combat WMD; and improve capabilities to perform WMD interdiction and elimination operations. Several significant accomplishments have resulted from this campaign. In 2007, the DOD International Counterproliferation Program (ICP), for which DTRA is the Executive Agent, provided 44 training missions in 16 countries to improve the capabilities of border guards, customs officials, and law enforcement organizations. DTRA also is promoting regional CWMD collaboration with the goal of establishing a global network that strengthens our defense-in-depth against WMD. We initiated this concept in the Black Sea region by hosting conferences, sponsoring a regional exer-

cise, and developing links to regional organizations. DTRA also supported the establishment of STRATCOM's Joint Elimination Coordination Element (JECE) to perform activities and operations necessary to train and prepare joint forces and Command and Control elements to conduct WMD elimination missions. The JECE achieved Interim Operational Capability in August 2007 through its participation in Exercise Ulchi Focus Lens 2007 in South Korea.

Campaign 3 - Eliminate WMD as a Threat to Warfighter

The focus of this campaign is to develop and manage applicable research investment strategies and coordinate science and technology efforts that provide DOD with operational capabilities, research and development, and technical subject matter expertise for Passive Defense, Installation Protection, Consequence Management and System Survivability. During 2007, DTRA performed mission survivability, vulnerability, and critical infrastructure assessments in support of OSD, the Joint Staff, the COCOMs, the Services, other DOD components, the IC, and DHS at home and overseas. Under joint management with the Department of the Army, the Transformational Medical Technology Initiative should provide capabilities against future genetically engineered biological threat agents for which our present countermeasures might be ineffective. This ambitious initiative holds great promise for not only developing broad spectrum medical countermeasures, but for also paving the way to establishing an enduring capability for DOD and the Nation to meet the emergence of a novel biological threat with an accelerated sequence of steps that result in production of medical products within a responsive timeframe. The Chemical and Biological Defense Programs seeks to exploit emerging nanotechnology, biotechnology, information technology, and cognitive science technologies to support detection and individual and collective protection. We are working with the Army on advanced materials integration for the next generation ground soldier system, and seeking opportunities to coordinate early with Major Defense Acquisition System development programs to determine where more seamless integration of burden-free protection technologies may render our warfighters immune from concerns about biological and chemical agents.

Campaign 4 - Protect the Homeland from WMD

This campaign is designed to provide crisis and consequence management support to the DOD and civil authorities to prevent WMD attacks and/or mitigate their consequences on the homeland and also focuses on sharing these capabilities with international partners. It leverages expertise through education, training, and exercises; operating concepts; and technologies and tools to develop CWMD-related homeland defense capabilities. An important element of this campaign is the Defense Threat Reduction University, which we envision becoming a premier national capability to integrate Federal, state, and local CBRNE training and education. DTRA deploys specialized Consequence Management Teams and provides WMD Reachback expertise and decision support tools from its Operations Center to the U.S. Northern Command and the National Guard WMD Civil Support Teams. We share our mission assurance expertise with Federal, State, local, and non-governmental organizations to enhance Critical Infrastructure and Defense Industrial Base protection. DTRA also sponsored the U.S. European Command's Exercise Flexible Response 08, a command post consequence management exercise involving multiple CBRNE events. Conducted overseas, this exercise demonstrates the defense-in-depth that is essential to protecting the U.S. homeland and relied upon the same basic consequence management expertise that DTRA could provide in response to WMD events inside our border.

Campaign 5 - Transform the Deterrent

This campaign is the cornerstone of our continuing support operations to the U.S. strategic deterrent. Our nuclear safety, security, control and reliability programs are all integral parts of our enduring nuclear strategic support mission. Additionally, this campaign is designed to provide research and development, as well as operational and technical expertise, to support the COCOMs in holding WMD and associated infrastructure and leadership at risk through offensive means. The goals are to provide the COCOMs the capability to identify, characterize, plan, interdict, target, execute, and assess any WMD-related target; and to have all offensive options, to include conventional, unconventional, and nuclear capabilities to dissuade, deter, and defeat potential adversaries. For example, we have several efforts underway to defeat hard and deeply buried targets, beyond the HTRAC which I previously mentioned, including the development of the Massive Ordnance Penetrator (MOP) which will greatly improve our conventional hard target defeat capability; and, target assessment capabilities including expanded reliance upon advanced modeling and simulation. In August 2007, at the request of the U.S. Central Command Air Forces,

a team of DTRA personnel was sent to the Tora Bora region of Afghanistan to perform assessments at several cave sites that had been bombed by the U.S. The technical information gained by this team has advanced our understanding of the effectiveness of our weapons against such important targets. DTRA also supports the U.S. nuclear deterrent by providing tools for hardening critical systems against nuclear weapons effects and providing support to the STRATCOM nuclear planning mission. We also provide OSD and the Joint Staff with an independent assessment of nuclear weapons capable units, and provide assurance that Personnel Reliability Programs are properly managed at the nuclear-capable COCOMs. Through the Mighty Guardian Force-on-Force test series, we evaluate nuclear security policy. We have developed and fielded the Defense Integration and Management of Nuclear Data Services program that provides a DOD-wide stockpile database system of record for nuclear weapons in DOD custody.

Campaign 6 - Business Excellence

Our Business Excellence campaign supports DTRA in its mission through timely, effective, efficient, and productive business processes; globally available secure information 24/7; and a diverse, agile, and highly competent workforce. It is improving, simplifying, and automating business processes, resulting in greater customer service and increased capabilities; providing state-of-the-art information operations support to accomplish mission execution; and creating robust human capital strategic planning; establishing effective recruiting, retention, and rewards programs; and facilitating dynamic career development. Recent accomplishments include the first successful Agency-wide transition to the National Security Personnel System; implementation of the Defense Travel System which has resulted in employee reimbursement of travel costs in as little as 3 days; and electronic transaction of invoices between vendors, DTRA, and the Defense Finance and Accounting Service. Through these accomplishments, DTRA has improved business practices enabling realignment of existing resources to support core mission activities, enhanced responsiveness to external seniors, partners, and customers, and improved management visibility and control of agency resources.

Campaign X - Defeat the Threat of Loose Nuclear Weapons

This campaign specifically responds to the challenge posed by potential WMD nuclear terrorism as outlined in the National Security Strategy and the National Strategy to Combat Terrorism. Key elements of this campaign include partnerships with intelligence agencies to advance warfighters' WMD knowledge base; detection of nuclear weapons and fissile material at stand-off ranges; establishment of a post-detonation technical forensics capability that more quickly characterizes fissionable materials; and providing decision makers with a spectrum of elimination options that will secure loose nuclear weapons while eliminating potential consequences. DTRA also performs the DOD mission of providing radiological sampling and analysis capability in support of post-nuclear detonation attribution and forensics as part of the National Technical Nuclear Forensics (NTNF) program. In 2007, DTRA developed forensics tactics, techniques, and procedures and tested these in four exercises; procured, tested, and evaluated equipment; and deepened our relationship with our partners across DOD, and the Departments of Justice (DOJ), DHS, DOS, and Energy (DOE). We continue to refine NTNF post-detonation TTP and equipment to improve operational capability, and will participate in an end-to-end exercise involving all NTNF partner agencies in October 2008.

I will use Campaign X as the context for highlighting some of our most important advanced CWMD technology development programs. I will review the DTRA role in defeating loose nuclear weapons, address the operational and technical challenges, and describe the broad spectrum approach being taken by DTRA to address this challenge.

DOE provides radiation detection equipment at fixed locations overseas and DHS has the responsibility for radiation detection at points of entry into the United States. As such, DHS is the lead for the "home game." DOD has responsibility for locating and defeating nuclear weapons in terrorist hands overseas and, therefore, is responsible for the "away game."

DOD must perform this responsibility in a very stressing environment with unique requirements. For example, while DHS can field large detectors supported by an existing infrastructure where size, weight, and portability are not significant design considerations, DOD may be called upon to look for a terrorist nuclear device anywhere in the world, in environments such as deserts, mountains, and jungle. This means that the detectors and other equipment that we need must be highly portable, self-sustaining light-weight, reliable and accurate, and capable of being rapidly deployed with a minimal supporting "footprint." Whereas DHS attempts to

defeat the threat at chokepoints, DOD has to search large geographical areas to locate and then defeat the threat. Therefore, DOD is far more interested in long-range surveillance, search, and localization, which makes active rather than passive detection much more attractive. Furthermore, if operating in sparsely populated areas, health and safety requirements associated with active detection may be of lesser concern than inside the United States.

While DOD has unique requirements and needs, it is fully integrated into the global nuclear defense architecture of the Domestic Nuclear Defense Organization (DNDO) and we are fully partnered with DNDO and DOE in developing detection technology. The urgency is great and the resources are too limited to permit anything other than a fully integrated national nuclear defense capability that provides protection in depth from overseas to the homeland.

We see significant operational and technical challenges in defeating the threat posed by loose nuclear weapons. With regard to intelligence, we need to enable greater transparency and cooperation among the players. From the perspectives of detection prior to attack and forensics after attack, materials cannot now be easily detected and characterized. If we are unable to physically gain control of the weapon, our stand-off options for eliminating or neutralizing it while still in terrorist hands are quite limited and must minimize collateral damage.

Campaign X integrates technical and operational approaches to defeating loose nuclear weapons with the goal of fielding "game changing" capabilities that reduce operational constraints, reduce equipment and personnel requirements, meet detection coverage area, increase the probability of detection, and permit more rapid search over a much larger area.

To provide the warfighters an unprecedented level of information regarding loose nuclear weapons, DTRA is partnering with the IC to provide enhanced synergy, collaboration, and fusion capabilities; develop a persistent intelligence, surveillance, and reconnaissance capability for WMD production, storage, and processing facilities; and develop associated battle management concepts.

Our key objective for detection is to provide the capability for locating and tracking nuclear weapons or nuclear materials at stand-off distances. We are emphasizing active detection technology and techniques as the critical enabler. Until we can field active detectors, we are working hard to improve our existing passive detection capabilities.

With regard to elimination, we are investing in nondestructive alternatives and nuclear shut-down devices, as well as improved targeting options for our existing weapons.

Should a terrorist nuclear device be exploded in the U.S., we must do all we can to prevent follow-on nuclear attacks. DTRA has responsibility for gathering the samples needed for post-detonation forensics so that, with additional information, the national leadership can confidently undertake appropriate responses in a timely manner. In addition, post-detonation forensics could provide important clues that will help us in our efforts to head-off follow-on attacks. Therefore, we are placing a high priority on developing an accurate, rapid, and reliable capability to characterize post-detonation materials and prompt data resulting from nuclear and radiological attacks. Specifically, we are looking at improved personnel protection equipment for manual collections, as well as prompt sample collection and evaluation.

In addition, we are developing and will be exercising a national strategy for loose nuclear weapon scenarios. Our goal is to provide tactics, techniques, and plans supporting national scenarios and capabilities. We are partnering with the warfighters to get additional capabilities integrated into their CWMD plans. In addition, we are integrating DOD CWMD capabilities with other U.S. agencies to develop comprehensive action plans for a variety of scenarios.

DTRA TOMORROW

As we look toward the future, we face several challenges. First, all the forecasts we have suggest that the future for CWMD will be more complex, not less. Second, national CWMD expertise is limited and must be nurtured and revitalized. Third, resources are finite and stretched thin, not only in DTRA, but among our partners as well. Lastly, our relationships with our partners must continue to deepen.

I am confident that our campaigns will be influential in guiding us through these challenges. Our campaigns have already done much to identify capability gaps, provide meaningful ways of assessing our progress in filling those gaps, and maximizing the full potential of the agency and focusing it on achieving enhanced CWMD capabilities.

DOD strategic planning guidance and our campaigns have identified several areas requiring increased emphasis in the coming years. These include:

Weapons Effects

Since the end of the Cold War, there has been a well-documented reduction in the U.S nuclear weapon effects enterprise including expertise, testing, test facilities, basic nuclear physics knowledge, research and development, modeling and simulation (M&S), and military training for operations in nuclear environments. DTRA programs in these areas similarly have been scaled-back. At the same time, the range of nuclear threat environments and scenarios continues to grow in number and diversity. DTRA believes that it must transform the way we support CWMD by developing deeper understanding of the phenomenology and effects underlying the WMD threat using advance High Performance Computing (HPC)-based M&S tools, and providing decision support and courses of action options for our customers. We are looking at three related focus areas: knowledge development using HPC-based M&S and validation testing; tools, technologies, and expertise to enable the survivability of DOD systems in a nuclear environment; and a comprehensive suite of analytic tools to support warfighter mission planning and operations in a nuclear environment.

Nuclear Forensics

We believe that improved capabilities are needed for prompt nuclear effects data collection and analysis, debris sample collection and field screening measurements, debris analysis to develop novel approaches and new technologies for more rapid and precise isotopic measurements, and data evaluation and knowledge management.

Enhanced Combat Support Operations

Combat support operations have become more than simply supporting just the COCOMs. Due to the nature of the war on terrorism and the CWMD mission, combat support now requires an interagency approach. In addition, DOD's Security Cooperation Guidance makes daily operations in security cooperation activities a vital element of our Nation's security. Such CWMD-related activities, in concert with those made by our allies and friends, help shape the regional security in a manner consistent with our national security objectives. As both a Combat Support Agency and as the DOD CWMD Agency, DTRA has a unique viewpoint and expertise that could assist with the development of a comprehensive organizational approach for expanding combat support operations, developing regional counterproliferation strategies, expanding the CTR Program beyond the Former Soviet Union, and enhancing homeland security.

Collaboration with the Intelligence Community

How can we more effectively support that community in WMD threat anticipation? What more can we do to assist with the identification of proliferation pathways and opportunities for interdicting WMD and related materials and means of delivery?

Hard and Deeply Buried Target Defeat

While we have worked hard at developing new non-nuclear means, such as thermobaric warheads and the MOP, for defeating such targets, we have learned from recent combat assessments in the field that we have not progressed as much as we had initially believed. In fact, in this contest, the defense is prevailing and our offensive capabilities are at risk of falling farther behind. DTRA believes that we can find newer and innovative non-nuclear ways of holding such targets at risk. Part of the solution might be through the development of novel weapons based on advanced energetic principles. We also need to significantly improve supporting M&S capabilities.

Additional considerations are also influencing our strategic thinking and planning. For example, do we have the right focus on and presence in Asia and the Pacific? What will be the combat support requirements for the new U.S. African Command? How might future arms control treaties and other such arrangements be different from those of our historical experience? In what ways will CTR Program Expansion beyond the Former Soviet Union evolve? How can we provide expanded assistance for Homeland Defense? How can we develop and retain the next generation CWMD workforce? These are difficult questions, but ones that we must squarely address.

CONCLUSION

Mr. Chairman and members of the subcommittee, what has taken place over the past decade regarding the CWMD mission has been significant. We now have a strategy in place, specific mission direction and guidance, a network of expanding

partnerships, focused research and operational support, and a sound investment strategy—all underpinned by the expertise and dedication of our workforce. DTRA and its partners are steadily increasing the Nation's CWMD capabilities.

We still face challenges. Foremost among them is that the threat posed by WMD is growing. Second, no single department or organization has an encompassing solution to the problem. Successfully meeting this threat requires the full integration and synchronization of national and international capabilities. This is particularly important since resources and expertise are limited.

DTRA's fiscal year 2009 budget request represents a balanced program across all of the agency's mission responsibilities to meet the challenges facing us. It also represents a balance in satisfying near-term combating WMD requirements at a high level of performance within available resources, while identifying and developing capabilities to meet future challenges. I also request your support of the STRATCOM mission to combat WMD. Our strategic vision is to make the world safer from WMD. Our budget and programs are designed with that in mind.

DTRA greatly appreciates the strong support that Congress has steadily provided over the past decade. We hope that you will join us in celebrating our 10 years of progress by participating in symposia and other events that we will host during our 10th anniversary year celebration. I look forward to working with you in further reducing the WMD threats facing our Nation.

Senator REED. Thank you very much, Doctor.

General Reeves? Again, you can summarize, but don't feel constrained by the clock.

STATEMENT OF MG STEPHEN V. REEVES, USA, JOINT PROGRAM EXECUTIVE OFFICER FOR CHEMICAL AND BIOLOGICAL DEFENSE, DEPARTMENT OF DEFENSE

General REEVES. Thank you, Mr. Chairman. I am honored to testify today on behalf of the DOD chemical/biological defense program, the United States Army as the program's executive agent, and as the JPEO/CBD.

As requested, I will summarize my remarks. On a daily basis, we are asked to do three things in this program. First is support for the force in current operations. Second is to improve our fielded capability. The third thing is to build for the future.

It is the rapid pace that Dr. Tegnelia referred to of chemical and biological technology development and, unfortunately, its proliferation in the information age and the globalization of that technology and expertise that tends to broaden our threat context today. This is going to make uncertainty the defining characteristic of the present and future environment. So we now have to prepare our forces for a much broader array of threats, including toxic industrial chemicals and materials, while also preparing for future threats.

To counter that existing threat, in the past year, we have fielded over 1.2 million individual items of equipment, and you saw some of the examples of that equipment today in this room. In coordination with the Department of Health and Human Services (HHS), we have provided anthrax and smallpox vaccines to both our warfighters as well as to the U.S. Strategic National Stockpile.

We have also strengthened our partnerships over the last 5 years with Federal, State, and local agencies to ensure our military installations are prepared to mutually support and interoperate in the civilian communities in which they reside. We fielded critical incident response and protection capabilities in support of the National Guard as well as the U.S. Army Reserve.

As we look to the future, our goal is to ensure that we are never technologically surprised. Again, as Dr. Tegnelia alluded to, it is

the emerging sciences of genomics and proteomics, and the tools of genetic engineering that are not only creating great opportunities for us, but also the potential for our adversaries to develop new and previously unknown toxins, viruses, and bacterias.

So we are working with nano biological information and cognitive technologies to develop a broad spectrum capability needed to counter these uncertain advanced threats. For example, we are leveraging information in biotechnology developments that are enabling us to develop capabilities for rapid identification and the genetic sequencing of unknown threats and the creation of a broad spectrum therapeutic countermeasure that we refer to as the Transformation Medical Technology Initiative.

We also have multiple interagency and international partners. For example, in the physical sciences, we work collaboratively with DARPA and the DHS. In pharmaceutical development, we work very closely with the HHS.

Even with this progress, challenges remain. Stand-off identification of chemical and biological agents, developing detection protection and decontaminant capabilities for all hazards, common test and performance standards across our agencies and our operations, and toxic industrial chemicals and the unique atmospheric conditions in an urban environment for chemical, biological, and radiological protection.

Mr. Chairman, Mrs. Dole, I do want to thank you for allowing me to testify today. Your continued support to the chem/bio defense program is crucial for our military and for our Nation to succeed in defeating WMD. We fully recognize that even the smallest use of these weapons can create an environment of instability, doubt, and fear among our allies and citizens at home, and we believe we are fielding equipment and pharmaceuticals for our Armed Forces and deploying interoperable systems at our installations worldwide to address this threat.

We are in the process of developing broad spectrum technologies to counter the evolving threat, and we are working closely with our interagency partners to defend the Homeland. With your guidance and assistance, we believe together we are bringing future technologies forward to protect our military and the Nation against chemical, biological, radiological, and nuclear threats.

Thank you very much.

[The prepared statement of General Reeves follows:]

PREPARED STATEMENT BY MG STEPHEN V. REEVES, USA

1. INTRODUCTION

Mr. Chairman and distinguished members of the subcommittee, I am honored to testify on behalf of the Department of Defense (DOD) Chemical and Biological Defense Program (CBDP), the U.S. Army as the Program's Executive Agent, and as the Joint Program Executive Officer for Chemical and Biological Defense (JPEO CBD) regarding technologies to combat Weapons of Mass Destruction (WMD).

As stated in the 2008 Army Posture Statement, persistent conflict and change characterize our strategic environment. We will confront highly adaptive and intelligent adversaries who exploit technology, information and cultural differences to threaten the interests of the United States. While advances in technology are benefiting people all over the world, extremists are exploiting that same technology to manipulate perceptions, export terror and recruit the people who feel disenfranchised or threatened by its effects. The diffusion and increasing availability of technology increases the potential of catastrophic nuclear, biological and

chemical attacks. Many terrorist groups and organizations are assessed to be actively seeking WMD.

Today I will address how we in the CBDP do three things to minimize the impact of nuclear, biological and chemical attacks; we support the Force and ongoing operations, we field improved capabilities and we build for the future. My testimony today will touch on all three of these missions from the perspective of the challenges posed by the evolving WMD threat. Additionally, I will discuss how we are collaborating with others to harness the technologies necessary to generate capabilities for mitigating that threat. First, however, I will briefly describe the CBDP.

Public Law 103–160 Establishes the CBDP

Enacted by Congress in 1994, Public Law 103–160 designated the Assistant to the Secretary of Defense for Nuclear and Chemical and Biological Defense Programs as the focal point for oversight of the CBDP, and it designated the U.S. Army as the DOD Executive Agent for certain key aspects of the CBDP. It also consolidated all chemical and biological warfare defense training activities of the DOD at the U.S. Army Chemical, Biological, Radiological, and Nuclear School.

The Assistant to the Secretary of Defense for Nuclear and Chemical and Biological Defense Programs is responsible for overall coordination and integration of the CBDP and exercises oversight through a Defense Acquisition Board process.

The U.S. Army, as the CBDP Executive Agent for the DOD coordinates and integrates research, development, test and evaluation, and acquisition requirements of the military departments for chemical and biological warfare defense programs.

The CBDP and the National Military Strategies

Today our Armed Forces execute a wide range of missions from traditional combat to homeland defense, civil support, installation protection and consequence management to special operations, counterterrorism, security and police actions. Our CBDP strategic context incorporates the guidance from multiple national and military strategies. Our CBDP strategic context reflects the potential for layered missions and tasks, operations in and from forward areas, and maintenance of capabilities and forces to wage multiple campaigns in a given timeframe.

The National Strategy to Combat WMD established the three pillars of our national strategy. The pillars; nonproliferation, counterproliferation, and consequence management, and their four crosscutting enabling functions form the foundation of a seamless layered defense. The 2006 National Military Strategy to Combat WMD supports the national strategy and provides to the Services, combatant commands, and military planners a strategic framework for combating WMD. In accordance with this strategy DOD seeks to "dissuade, deter, and defeat those who seek to harm the United States, its allies, and partners through WMD use or threat of use and, if attacked to mitigate the effects and restore deterrence."

Based on this strategic framework, DOD developed a force planning construct. The CBDP utilizes the DOD force planning construct as the foundation for identification and analysis of required capabilities to ensure that operations are unconstrained by chemical, biological, radiological, and nuclear effects. This vision brings together doctrine, organization, training, materiel leadership and education, personnel, facilities and technology in a manner as to eliminate the burden currently imposed upon our warfighters by chemical, biological, radiological, and nuclear defense equipment.

The CBDP uses the "operational attributes" or capability areas of sense, shield, sustain, and shape as core capabilities in which to categorize chemical, biological, radiological, and nuclear technologies and capabilities. The CBDP provides technologies and capabilities to sense chemical, biological, radiological and nuclear hazards, shield (protect) the force from these hazards, sustain the personnel and equipment while restoring combat power and recovering from the effects of the hazards, sense the presence of hazards and shape the chemical, biological, radiological and nuclear environment by enabling the joint force commander to understand the current and predicted chemical, biological, radiological, and nuclear situation. These technologies can often be directly used or adapted to provide the commanders with the capabilities required to support various aspects of the five counterproliferation missions which include; passive defense, offensive operations, elimination operations, interdiction operations, and active defense. The use of these sense, shape, shield, and sustain core capability areas support the active, layered, defense-in-depth that has been established to dissuade, deter, and defeat those who seek to harm the United States, its allies, and partners through WMD use or threat of use.

The CBDP is a critical component of the DOD efforts to support national and military strategies in combating WMD. During the rest of my statement, I will focus

on how the CBDP is providing the best chemical and biological defense capabilities in support of these strategies.

2. THE NEW THEORY OF WAR

The rapid pace of chemical and biological technology development and proliferation through the information age, as well as globalization of technology and expertise has broadened the threat context

These facts make uncertainty the defining characteristic of the present and future environment. Where once the capabilities of our adversaries were generally well understood and their intentions unclear, we now face quite the reverse situation. The intentions of our adversaries are clear while their capabilities are more varied and expanding. Jihadist websites and public statements frequently refer to "decisive strategic operations with Weapons of Mass Destruction." The July 2007 National Intelligence Estimate on "The Terrorist Threat to the U.S. Homeland" concludes that "Al Qaeda will continue to try to acquire and employ Chemical, Biological, Radiological and Nuclear material in attacks" This view was again reinforced by the Director of National Intelligence as recently as February 5, 2008.

We must now prepare our armed forces for a much broader array of current threats, including toxic industrial chemicals and materials, while also preparing for future threats.

For example terrorists may soon be able to cause mass casualties, or create significant socio-economic impacts, that in the past were only possible for state-run biological weapons programs. Scientists can already engineer biological agents to enhance their lethality either through genetic engineering or other types of manipulations. Given the exponential growth in the field of biotechnology and global access to scientific information on the Internet, our vulnerability to this threat may be closer than we suspect.

Toxic industrial chemicals are present everywhere in the industrialized world and their availability and toxicity make a potent combination for use both in areas of conflict abroad and by terrorists at home. The ongoing efforts of nation-states, terrorists and even individuals to develop and/or acquire these dangerous agents, weapons and delivery systems constitute major threats to the safety of our Nation, our deployed troops, and our allies around the world.

Nation-states pose an additional biological weapons threat, and the weapons they can produce are potentially more sophisticated, and therefore more lethal, than those made by terrorists. While fear of retribution may deter nations from using biological weapons against the U.S., their covert use may be a different matter. States could attack the United States or its military installations and avoid retaliation by posing as terrorists.

The threat from the potential use of biological agents is expected to increase over the next decade as those countries now believed to have biological warfare programs, as well as additional states, terrorist groups and even individuals seek advanced capabilities. There is an increasing availability of biological warfare-related technology, materials, information and expertise, and publicity about potential vulnerabilities. Genetic engineering is just one of a growing number of biotechnologies that could allow countries to develop agents, such as modified viruses, that could make detection and diagnosis difficult and may defeat current protection and treatment protocols. Because of the dual-use nature of the materials needed to produce biological warfare agents, any country with the political will and a competent scientific base could probably produce agents.

The chemical threat is no less real, as demonstrated by the terrorists that used the traditional chemical warfare agent Sarin in the Tokyo subway system and in Matsumoto 13 years ago. This threat is likely to also grow in the coming years for several reasons. The increased availability of chemical technologies, coupled with the relative ease of producing some chemical agents, as well as the potential emergence of advanced/future agents has increased concern that production and use may become more attractive to states or terrorist groups in the future.

New adversaries drive new relationships between threats abroad and at home and a new concept of security for the American citizen

Terrorism threats to the Homeland, to our deployed troops, to our national security interests, and to our allies are the pre-eminent challenge we face today. While the use of conventional explosives is currently the most likely attack scenario, al Qaeda and other terrorist groups are attempting to acquire chemical, biological, radiological, and nuclear weapons and materials, and have already demonstrated a willingness to use them. Indeed, today we are more likely to see an attack from terrorists using chemical, biological, radiological materials than from nation-states, as

the Intelligence Community indicates that nearly 40 terrorist organizations, insurgencies, or cults have used, possessed, or expressed an interest in WMD.

Of the potential terrorist WMD threats facing the United States, those related to biological substances have evolved the most rapidly during the past 20 years. Unlike nuclear or chemical weapons, a biological weapon has already been used to attack the United States, in the form of the anthrax letter attacks in 2001. This still unsolved criminal attack killed five people, crippled mail delivery in several cities, and required decontamination efforts costing more than $1 billion.

The deliberate use of toxic industrial chemicals against people, territory, or property of the U.S. could produce severe consequences. Beginning in January 2007, insurgents in Iraq began the use of chlorine cylinders in improvised explosive devices. While to date these types of attacks have killed fewer people than conventional suicide bombs, it marked a new phase in the insurgency and has increased concerns that non-state actors will use toxic industrial chemicals or conventional chemical weapons in other countries. The risks to the United States by terrorist use of toxic industrial chemicals and/or chemical agents are very real with significant potential to affect public health, critical infrastructure, the environment, and the economy.

In conclusion, over the past two decades, the global WMD threat has grown significantly more complex and diverse. It has broadened from a focus on State threats to one that includes both state and non-state actors. Additionally, the WMD threat is not limited to a specific region or type of conflict. The threat, as well as our enemies, is evolving and therefore our strategy must be flexible and proactive.

3. DELIVERING CAPABILITIES NOW AND IN THE FUTURE

Supporting the Force: fielding and logistics support

We rapidly fielded many new capabilities and additional increments of existing capabilities in support of Operation Iraqi Freedom. These capabilities include toxic industrial chemical detectors, protective equipment, and decontamination capability; reconnaissance vehicles with enhanced toxic industrial chemical detection capability, armor and weapons, and; mobile vehicle inspection systems. We continue to provide in theater daily support for those systems both through resident Contractor Logistics Support contact teams and our JPEO CBD Chemical, Biological, Radiological and Nuclear Information Resource Center which operates on a 24/7 basis and serves as a single entry point for all requests for information related to the CBDP. This hot line can be accessed on line or via telephone by Service personnel throughout the world.

To counter the existing threat we field equipment and pharmaceuticals to support our Forces and current operation. In fiscal year 2007, we fielded equipment and pharmaceuticals in 48 States, 19 countries, and 3 continents. This included nearly 7,000 chemical detectors, over 200 biological detectors, over 2,000 radiation detectors, over 8,000 specialized protective suits and over 50 warning and reporting software systems. In coordination with the Department of Health and Human Services (HHS), we have provided over 2 million doses of Anthrax vaccine and annually provide over 500,000 doses of Small Pox vaccine. With delivery of this equipment, previously fielded equipment, and the associated training and doctrine, the U.S. military can better operate and succeed in the face of WMD on the battlefield. The CBDP invests approximately $1 billion a year to field capability and to develop advanced technologies that will allow us to keep pace with the threat.

Improving Capabilities: our Research and Development

As we stated earlier, the functional construct the CBDP uses to combat chemical and biological agents is termed sense, shape, shield, and sustain. Within those functions are specific capabilities and technologies such as detection, protection, information systems, and medical systems. We also field integrated systems such as the installation protection program and the National Guard Civil Support teams. I will next discuss highlights of the various technologies being developed and an assessment of where technology development is proceeding in each.

Sense Capability

The primary roles of sense capabilities are to provide chemical and biological detection and facilitate warning of a chemical and biological event so forces can assume a protective posture and avoid exposure. This is accomplished by deploying multiple point sensors upwind of forces and several stand-off sensors to scan wide areas not monitored by the point sensors. The early warning of potential hazards is critical to mission success. Without it, forces would be unlikely to react rapidly enough to avoid exposure. Chemical and biological detection is also used in restoring operations, consequence management and medical diagnostics.

Our current detector to address this threat is the automated chemical agent detector. Next year we will transition to the joint chemical agent detector which will provide improved detection capability at half the cost, a tenth of the weight and about one quarter the size of the automated chemical agent detector. This will allow chemical early warning detection capability to be fielded to more troops and integrated onto more platforms improving situational awareness throughout the DOD. Next year we will also field the joint service lightweight stand-off chemical agent detector as a sensor on the Stryker Nuclear, Biological, and Chemical reconnaissance vehicle. The joint service lightweight stand-off chemical agent detector is the first on-the-move, automated, passive infrared detector.

We have over 100 joint biological point detection systems in our inventory. The joint biological point detection system is the first automated system to routinely monitor the air for biological agents and provide presumptive identification for up to 10 agents via immuno-assay tickets. Next year we will field the joint biological stand-off detection systems, the first biological stand-off detector of its kind in the world. This detector uses a light detection and ranging system at two specific wavelengths to detect and classify airborne aerosols.

In response to the expanding number of biological threats, the push for detection technology to keep pace has led to the development of multiplex biological assays, the use of high-speed, high-throughput nucleic acid sequencing, linked with bioinformatics, and integration of multiple technologies in a micro-electro-mechanical systems platform. The multiplexed biological assays can provide presumptive identification for 10 plus agents per assay and is being considered for the next upgrade into the joint biological point detection systems to expand the number of detectable biological agents. Nucleic acid sequencing linked with bio-informatics will have the capability to assess the potential of an unknown organism to be a threat. This capability will be the foundation for next generation of biological detection system with the capability to address emerging and unknown biological threats. Micro-electro-mechanical systems technology has the potential to significantly reduce the size and cost of detection devices across the technological spectrum, and will provide us an enhanced capability to integrate different technologies into a single detector or platform.

As the CBDP develops new chemical and biological detectors, and as the nature of the threat and potential means of attack become harder to predict, it is necessary to integrate the most advanced capability into as many platforms and installations as possible. To that end, we have developed the common chemical, biological, radiological, and nuclear sensor interface standards. These standards define the architecture, common component interconnects, power, connector, and communications protocol standards and specifications that provide a plug-n-play capability for sensors and detectors through net-centric operations. The standards facilitate interoperability with command and control networks by providing a standard set of extensible commands and reports for interaction with sensors. They provide timelier sensor and detector information, improved sensor platform independence, improved sensor portability, and simplified integration of new sensors. The standards and specifications language will be used for all future sensor procurements. The standards are modular to support tailoring by acquisition programs to incorporate the capabilities they need.

Additional sense capabilities that are scheduled for delivery to the field are the joint biological tactical detection system (fiscal year 2011). This is a lightweight system that will enhance force protection and medical response decision. The system will detect the presence, provide warning and a presumptive identification, and collect samples of a biological threat agent.

Detection technologies developed and fielded by the CBDP are primarily used in the passive defense and consequence management mission areas of the counterproliferation pillar of the national strategy to combat WMD. However the core technologies can be adapted or re-engineered for other missions. For example, the immuno-assay tickets used in the joint biological point detection system are the same root technology that the National Guard Civil Support Teams use when presumptively identifying unknown substances such as anonymous “white powder” incidents for homeland defense. The joint chemical agent detector chemical detectors used by deployed troops for passive defense can be used by sailors performing an interdiction operation at sea searching for chemical weapons, or ground forces securing suspect chemical facilities.

Shield Capabilities

Shield capabilities provide protection to the force from chemical, biological, radiological, and nuclear hazards by preventing or reducing individual and collective (group) exposure. Shield capabilities are aligned within two areas, individual and

collective protection. While shield capabilities also include those chemical and biological medical systems technologies that provide approved pretreatments (prophylaxis) for the warfighter we will speak to all medical systems within the "sustain" capability area.

This year we will begin fielding to all of the Services the joint service general purpose mask. This mask provides enhanced protection capabilities and reduced breathing resistance. We have also begun fielding enhanced boots, gloves, and a mask leakage detector to our forces as part of our strategy to incrementally enhance individual protection capabilities. Additional shield systems that are scheduled for future delivery to the field include both fixed wing and rotary wing variants of the joint service aircrew mask.

The unpredictable nature of the evolving threat drives our vision toward embedding a level of chemical, biological and radiological protection into our forces' standard combat uniform or tent materials without degrading their ability to operate. At the same time, we must provide protection against a wider range of threats tailored to specific user communities which optimize human performance and reduce logistical impacts. Technological advances provide an opportunity to revolutionize our future approach to individual and collective protective equipment by providing a modular family of systems. These technological advances are coming from both industry and government research and development efforts. Technological solutions, such as imbedded reactive materials and nanofibers, are ready now for further refinement and development into a joint combat ensemble (family of systems) that optimizes and enhances protection while meeting the diverse needs of the ground, mounted, air, and special operating forces.

A number of new technologies offer considerable opportunities for achieving integrated low-burden protection against a broadening threat spectrum without compromising needed performance. One of the most exciting areas is reticular chemistry, which is described as "the linking of molecular building blocks of synthetic and biological origin into a predetermined structure using strong bonds." The most well known class of these materials is metal organic frameworks which have already exhibited absorbency potentials that far exceed activated carbon, and are currently being manufactured in commercial quantities. These compounds can be tailored to target specific classes of chemicals that include the high volatility toxic industrial chemicals which limit the performance of current technologies. Such compounds can be used to design smaller and lower-profile filters for protective masks and collective protection systems that protect against the expanding spectrum of threats. Smaller and lower profile filters decrease weight and reduce interference of the respirator or protective shelter filter systems with other mission systems. Another promising area has been the development of nanofibers. It may soon be possible to produce particulate filters for protective masks with order-of-magnitude lower pressure drop, and high efficiency particulate filtration capabilities that can be built into the clothing. Additional developing technologies will make it possible to assemble these fibers into nano-composites that will enable built-in adsorption, reactive, anti-microbial and sensing capabilities into a thin coating. This could revolutionize protective clothing and collective protection and produce unconventional and extremely low burden approaches to respiratory protection.

Shape Capabilities

Shape capabilities enhance the commander's situational awareness on the battlefield. These capabilities are the heart of the layered, integrated, chemical, biological, radiological, and nuclear defense model. There are three capabilities that are being developed and fielded; a warning and reporting capability, a hazard prediction model, and an operational effects model.

We have fielded approximately 50 Block 1 versions of the joint warning and reporting network software that enable warfighters to seamlessly integrate chemical, biological, radiological, and nuclear sensor data into a common command node. We are in the development phase of the next joint warning and reporting network increment that will integrate into more Service command and control systems, provide additional networking capability, and interface with additional chemical, biological, radiological, and nuclear sensors.

Near the end of this fiscal year, we will field the joint effects model. This model will provide warfighters with the DOD accredited modeling capability to predict high-fidelity, downwind hazard areas and effects associated with the release of chemical, biological, radiological, nuclear, and toxic industrial hazards into the environment. The model also incorporates the impacts of weather, terrain and material interactions into the downwind prediction and provides enhanced situational awareness of the battle space.

Also in development is the joint operational effects federation that will enable warfighters and planners to estimate chemical, biological, radiological, nuclear, and toxic industrial material effects on personnel, equipment, and operations. The joint operational effects federation will enable the conduct of defensive planning to minimize or eliminate the threats and carry out effective consequence management in response to contamination when it occurs. The joint operational effects federation is expected to begin fielding in fiscal year 2009.

We are leveraging the advances that we have made in developing these capabilities to perform consequence management. These activities include developing modeling and simulation software to assist planners in estimating the potential human casualty that might result from a chemical, biological, radiological, and nuclear attack. Our research has lead to the building of advanced software tools that allow the simulation of the hazard environments posed by WMD across a broad array of scenarios. These scenarios include both military operations and homeland defense scenarios that encompass high altitude missile intercepts, urban environments, building interiors, military installations, coastal and littoral, as well as a variety of military operational settings. We are also investing in the development of a sensor data fusion capability to allow the fusion of information and data from diverse detectors and sources to provide the warfighter with a more refined common operating picture of the battlespace with respect to chemical, biological, radiological, and nuclear weapons.

Sustain Capabilities

Sustain capabilities include decontamination capabilities and medical capabilities. Decontamination technologies remove and neutralize contamination and detoxify contaminated material without damaging combat equipment, personnel, or the environment. Chemical and biological medical capabilities include both prophylactics (pretreatments) and therapeutics (treatments).

We have many challenges in this area; to include an "all-hazards" decontaminant that places a minimum logistic burden on the operational forces. Technology advances in neutralization technologies such as those found in the reactive skin decontamination lotion, which we will field this year under the joint service personnel/skin decontamination program, have resulted in a significant (up to 15,000 percent) improvement in our ability to provide a skin decontamination capability against future threat agents. We continue to look at technologies that provide coatings, catalysts, and other means to reduce the logistics burden, manpower requirements, and lost operational capability associated with decontamination operations. Our decontamination science and technology efforts are focused in five areas: 1) decontamination-enabling sciences: 2) traditional approaches to decontamination: 3) energetic and kinetic decontamination: 4) smart system decontamination: and 5) self-detoxification processes.

Developing and fielding new chemical and biological medical systems technologies provides Food and Drug Administration (FDA)-approved prophylaxis, therapeutics, and diagnostics. Chemical, biological, radiological, and nuclear medical systems include all pharmaceuticals, biologics, and devices that preserve combat effectiveness by timely identification, diagnosis, and providing medical countermeasures in response to joint service chemical, biological, radiological, and nuclear defense requirements. The program is developing safe, effective, and affordable medical countermeasures to ensure the effectiveness and survival of U.S. warfighters against validated military threats in a chemical and/or biological warfare environment by maintaining uncontested global supremacy in the development and delivery of chemical, biological, radiological, and nuclear medical countermeasures. Developing and acquiring new medical chemical and biological technologies and products entails using government and commercial best practices to obtain FDA-approval of chemical, biological, radiological, and nuclear medical countermeasures and diagnostics within benchmark timelines. These best practices have helped keep 80 percent of chemical and biological medical products (approved or in development) on track in terms of safety and effectiveness. This success rate is exemplary when compared to the 10–20 percent of products that achieve FDA approval within the industry benchmark.

Chemical, biological, radiological, and nuclear medical systems technology development is continuously advanced through focus on partnering with the science and technology base, international partners, and industry to reduce technical and cost risks, to ensure regulatory compliance, and to align transition opportunities with capability gaps. For example, the CBDP is working with the Defense Advanced Research Project Agency (DARPA) to shorten development time and decrease the costs of vaccine development. We are collaborating with HHS to form a joint national stockpile for fielded products and continued cooperation on numerous developmental

products. A joint stockpile currently exists for the smallpox vaccine and one is being developed for the anthrax vaccine.

One of our major initiatives in the area of chemical and biological medical therapeutics is the Transformation Medical Technology Initiative, which we will address in our ongoing CBDP initiatives to build for the future.

Improving Capabilities: Dual Use (Military and Civil) and Multi-Use (across the spectrum of WMD operations) capabilities can mitigate the new threat relationships and the new concept of security

Given a common threat to both the U.S. military and the Homeland, the same basic technologies provide useful increments of capability. The difference is a matter of engineering to ruggedize, ensure interoperability, and other environmental and mission attributes.

However, this area poses significant challenges. Among them is the absence of many national standards for detection and other capabilities. There are dual standards (one for civil and one for military) for items such as protective equipment. In addition to the need to create synchronized standards of performance, another area that poses a challenge are the differences in test capabilities and methodologies that frequently exist between a national standard, such as those established by the National Institute for Occupational Safety and Health for respiratory protection, or those established by the National Fire Protection Association for percutaneous protection, and the existing military standards and test methodologies.

Two of the ways DOD has worked to address this challenge is the nonstandard equipment review panel, a process we have set up to apply in cases where national standards do not exist, and our work with the Office of Federal Procurement Policy to establish a policy that facilitates DOD selling equipment and services developed for the DOD to State and local community first responders. In the case of national standards, in the long-term we are working through organizations such as the interagency board for equipment standardization and interoperability to ensure standards are created where they do not exist and are synchronized where they conflict. This board is designed to establish and coordinate local, State, and Federal standardization, interoperability, compatibility, and responder health and safety to prepare for and respond to any incident by identifying requirements for an all-hazards incident response capability.

In a similar effort we are also working directly with the Department of Homeland Security (DHS) to develop integrated process and procedures for the Biowatch program, to include common reporting protocols and the integration of Biowatch collection and detection into our operational networks.

As previously described, we are making progress in the development of dual use technologies in areas such as detection with our joint biological point detection system and the joint chemical agent detector systems.

DOD has also procured and employed numerous commercial technologies to significantly augment operational military capabilities. These include chemical detection and identification, biological detection and identification, radiological, and nuclear detection systems, individual protection, decontamination and information management, and warning. We have ongoing efforts to address communications and interoperability. By leveraging open architecture design and web based communications systems we are improving the ability for military and civilian first responders to communicate and to interoperate.

Improving Capabilities: Military-Civil Integration can mitigate the new threat relationships and the new concept of security

A significant example of both the promise and challenges inherent in the integration of military and civil capabilities is the installation protection program. A key component of our support to the national security strategy of the United States in defeating WMD is ensuring that we can both protect and project our military forces. Furthermore, our homeland defense strategy calls for military support to civilian authorities. Both of these missions begin here at home. To accomplish this we must strengthen partnerships with Federal, State, and local agencies to ensure that our military installations are equipped to both protect the force and support surrounding civilian communities.

To protect our installations from WMD, we have applied a tiered concept to ensure appropriate and scalable level of response capability at each of our military installations. All installations receive at least a baseline tier of protection, which consists of a set of training products, planning guidance, exercise scenarios, and templates for developing exercises and mutual aid agreements. We facilitate the installation's coordination, and support to with their civilian counterparts by providing them with the guidance necessary to improve communication and information shar-

ing through memorandums of agreement. Such baseline resources are available to all military installations via the Installation Protection Program web-based portal.

The next level of protection, known as Tier 1, includes government and commercial off-the-shelf emergency response equipment such as protective suits, pharmaceuticals and breathing apparatus for first responders, as well as portable detection equipment, decision support tools, and mass notification and warning capabilities in addition to all baseline tier capabilities. The final level of protection, Tier 2, builds on the baseline and Tier 1 capabilities, and includes an enhanced decision support system, fixed sensors for chemical, biological and radiological detection, and protection for mission critical facilities.

Our approach for ensuring interoperability and military support to civilian authorities was developed from the 2006 Chemical, Biological, Radiological, Nuclear and High-yield Explosives Installation Protection Study sponsored by the Assistant to the Secretary of Defense for Nuclear, Chemical and Biological Defense Programs and the Joint Requirements Office. This study highlighted the complexities of a chemical, biological, radiological, and nuclear response, identified interoperability gaps, and reinforced the inherent co-dependency of installations and the civilian community on the assets and capabilities of both.

To address the gaps identified within the study, we established the Installation Protection Steering Group. This group is charged with overseeing efforts to develop and/or clarify installation protection standards, transitioning DOD from a previously limited focus to an all-hazards approach. This holistic approach is consistent with civilian emergency preparedness and management efforts and will provide for a more unified response to a wide range of natural and man-made threats.

In addition, through our partnership with the DHS and the relationships we continue to foster with each of the Services, we have participated in efforts to leverage existing civilian capabilities such as those provided by the BioWatch Program and the Domestic Nuclear Detection Office.

In 2007, we collaborated with BioWatch to collocate DOD and DHS bio-detection technologies on Andrews Air Force Base. This partnership resulted in several significant accomplishments:

- Enhancing assay equivalency work currently underway between the Centers for Disease Control and Prevention and DOD laboratories;
- Developing multi-agency (national and local) concepts of operations for event notification—the genesis for developing an expanded concepts of operations for the National Capital Region; and
- Relocating collectors within the National Capitol Region that seeks to optimize DOD and DHS biomonitoring capabilities—a strong first step in solidifying the national biomonitoring architecture.
- Using up to 25 DOD installations that have biodetection capability that provides BioWatch additional geographic coverage.

In addition, we have developed, procured and fielded critical incident protection and response capabilities in support of the National Guard Bureau and the U.S. Army Reserve. We have developed and fielded the Unified Command Suite to every National Guard WMD Civil Support Team in the country.

The analytical laboratory system provides enhanced sensitivity and selectivity in the detection and identification of chemical, biological and radiological agents or substances. The analytical laboratory system provides a science-based analysis of potentially hazard samples to gain and maintain a complete understanding of the contaminated environment. This is done to support informed decisions by a myriad of possible agencies over and above the typical incident commander or other official.

The Unified Command Suite is a self-contained, stand-alone platform that provides voice and data communication capabilities to the Civil Support Team Commanders and other agencies. It is the primary means of reachback communications for the Analytical Laboratory System and the Civil Support Team's, and acts as a command and control hub to provide a common operational picture for planning and executing an incident response. In August 2005, we deployed 13 sets of these systems throughout Louisiana and Mississippi in support of Hurricane Katrina recovery and relief efforts and they were critical in establishing secure, reliable communications links for the recovery and relief efforts.

Building for the future: Broad spectrum capabilities developed through Technology Mega Thrusts can mitigate the broadened threat context

As we look to the future, our goal is to ensure our forces are never technologically surprised. The rapid advances and convergence among the technology mega thrust areas of nano, bio, information, and cognitive technologies can assist us to develop the broad spectrum capabilities needed to counter the uncertain and advanced threat. Nano-technology is allowing us to manipulate the fundamental properties of

materials that can be used in protective clothing and masks and develop sensing elements that distinguish hazards across a broad range of chemicals. By its very nature, nano-technology will enable the embedding of this protection and sensing capability into not only soldiers' uniforms, but also across the range of military platforms. This integration and proliferation of capability will provide better overall force protection regardless of where troops are stationed.

Advances in bio-technology are enabling the CBDP to do several things. First, rapid genetic sequencing is providing the information necessary to understand the means of pathogenicity. Combined with bio-informatics, this genomic information will allow for the more rapid identification of unknown threats and development of therapeutics to counter these threats. Second, bio-technology combined with improved understanding of the human immune system enables the creation of broad spectrum therapeutic countermeasures. The Transformational Medical Technologies Initiative (TMTI) is our programmatic vehicle to harvest, develop and field these revolutionary capabilities.

Information and cognitive science developments are enabling the creation, dissemination, manipulation, and effective use of chemical and biological information on the battlefield. With the rest of DOD, the CBDP is migrating to a net-centric operating environment. No longer will information remain isolated or stovepiped. Commanders at all echelons will have the information they need regarding the chemical and biological hazard and the necessary information systems tools to take the appropriate protective, evasive, and restorative actions necessary.

As the sciences behind these technology mega thrusts converge, there will be technology developments that are broad-stroke in nature but more integrated into the capability needs of the operational forces. Genomic research will target convergence of biotechnologies for detection, diagnostics, and therapeutics. Likewise, developments in nanotechnology from various agencies will be leveraged for detection, protection, and hazard mitigation (decontamination) applications. As "intelligent" materials and technologies emerge from these efforts, the processing of information from nano-scale elements will require a convergence of research in information management, systems, and cognition as they relate to human factors in the design of future countermeasures technologies and for training on the use of these technologies.

Information and cognitive science developments are enabling the creation, dissemination, manipulation and effective use of information on the battlefield. The joint warning and reporting network, joint effects model and joint operational effects federation of models provide our commanders both situational awareness and analysis. With this information our forces are prepared to take the appropriate protective, evasive, and restorative actions necessary for mission success.

Building for the future: Setting the stage for rapid capability development across our capability spectrum can mitigate the rapid pace of threat development

Rapid advances in biotechnology present not only great opportunities, but also threats. The emerging sciences of genomics and proteomics and the tools of genetic engineering create the potential for our adversaries to develop and use previously unknown viruses, bacteria and toxins.

The TMTI is a system approach to defending against the conventional, emerging or genetically engineered biological threats. The approach is to use platform technologies, such as genetic sequencing, to accelerate the identification of the specific biological threat agent, development of broad-spectrum medical countermeasures, and the production of an effective countermeasure. Each countermeasure will act against the targeted agent by blocking critical molecular pathways essential to the success of the agent to affect the host.

While efforts like the TMTI are vital to our effort to lay the ground work for effective and rapid medical treatment against biological threats, we are using experimentation to assist us in rapidly analyzing the promise of new technologies to provide us capability across the WMD spectrum.

We use experimentation to examine how emerging technologies can be employed by soldiers, sailors, marines, and airmen to enhance their future chemical, biological, radiological, and nuclear defense capabilities. The joint combat developer for chemical, biological, radiological, and nuclear defense conducts joint limited objective experiments in order to exploit the technological opportunities that are identified by the Joint Science and Technology Office, Joint Requirements Office and the JPEO CBD. Experimentation helps to focus the developmental efforts of the acquisition program managers through a better understanding of the warfighter requirements which can ultimately translate into the acceleration of the acquisition process. A recent successful example of such an experiment was the joint chemical, biological, radiological, and nuclear dismountable reconnaissance system limited objec-

tive experiment which has enabled the acceleration of the second increment of the joint service nuclear, biological, and chemical reconnaissance system.

Experimentation helps us to better understand the warfighters needs and to better define the capabilities that emerging technologies can provide. To map what capabilities are required against emerging threat agents the CBDP has formed a working group and a toxic industrial chemical and toxic industrial material task force. The working group is the focal point for the coordination, alignment, and synchronization of advanced/future chemical agent defense capability development for the CBDP. This group provides integration and management visibility of efforts and provides a framework and plan-of-action for the capability development of material solutions to mitigate the effects of advanced/future chemical agents. The toxic industrial chemical and Toxic Industrial Material Task Force pulls together subject matter experts across the CBDP community to develop a standard and prioritized list of toxic industrial chemical agents for equipment and requirement development across the WMD defense capability spectrum.

Our test and evaluation capability for future equipment must also evolve consistent with the evolving threat. We have established a product director for test equipment strategy and support that, working in concert with the CBDP Test and Evaluation Executive, is developing the capabilities we will require to ensure future equipment is safe, effective and suitable.

Building for the Future: A portfolio approach to the acquisition of capabilities accelerates the exploitation of technological opportunities and the generation of new capabilities

Under the direction of the Under Secretary for Defense, Acquisition, Technology, and Logistics, the CBDP is working with Service and joint Major Defense Acquisition Programs (e.g. Joint Strike Fighter) to provide a portfolio approach exploiting technologies that deliver required chemical, biological, radiological, and nuclear capabilities. This will ensure the major defense acquisition programs can accomplish their primary missions unencumbered by chemical or biological contamination. The uncertain nature of the threat and potential asymmetric attacks in any area of operation requires that chemical and biological defense capability be integrated, modular, and tailorable throughout these programs. This portfolio approach integrates formally discreet areas of chemical, biological, radiological, and nuclear defense capability namely detection, protection, and decontamination into a system-of-systems. Viewing chemical, biological, radiological, and nuclear defense as a system-of-systems facilitates the insertion of new technologies and, through them, the development of new capabilities.

Exploiting chemical, biological, radiological, and nuclear defense technology opportunities will also facilitate future joint operational concepts. The joint chemical, biological, radiological, and nuclear defense concepts must be based on an integrated system-of-system view where chemical, biological, radiological, and nuclear defense packages can be modular, tailored to the mission, environment or situation. The objective is to provide commanders the flexibility to understand and act on the common operating picture without degrading operating tempo or survivability.

The common operating picture should include chemical, biological, radiological, and nuclear considerations based on data fused from multiple chemical, biological, radiological, and nuclear sensors and non-Chemical, Biological, Radiological and Nuclear sensor sources. These sensors should be modular, plug-and-play, and operate in a net-centric environment, meaning they should be transferable from one platform to another (e.g. soldiers can move sensors from Stryker vehicles to Mine Resistant Ambush Protected vehicles to Blackhawk helicopters as required.) Analysis and decision tools which integrate chemical, biological, radiological, and nuclear and non-chemical, biological, radiological, and nuclear information should enable rapid decisionmaking at the strategic, tactical, and unit level to protect the force. The goal is for all of our forces to fight and win in a CBRN environment.

4. GLOBALIZING OUR TECHNOLOGY AND EXPERTISE

International, Interagency, and Industry collaboration can mitigate the broadened threat context

The CBDP is actively involved in numerous cooperative efforts in chemical and biological defense material developments through bilateral, multilateral, and allied agreements and structures. These include the Australian, Canadian, United Kingdom, United States chemical, biological, and radiological memorandum of understanding activities, North Atlantic Treaty Organization joint consultative group chemical, biological, radiological, and nuclear activities, and bilateral forums with the United Kingdom, Japan, Republic of Korea, and other countries with advanced

development efforts in chemical and biological defense. These venues link the CBDP to government military and non-military research, development, and test and evaluation organizations involved in chemical and biological defense materiel development efforts. The JPEO CBD participates in the foreign military sales process to enhance interoperability with our allies, and cooperative development activities under these programs reduce our development costs through burden sharing and leveraging of others' significant investments in chemical and biological defense and increase our access to the broadest possible spectrum of available chemical and biological defense technologies.

The CBDP is also beginning to increase its leveraging of existing DOD and broader United States Government presence throughout the world as it searches for the best and most advanced technologies to meet its program requirements. Through more than 34 offices in 21 countries on 6 continents, we maintain awareness of all potentially beneficial foreign technologies that are available to meet our requirements. Together these efforts will ensure an ability to identify, assess, develop, and exploit military and civilian technology and materiel developments in chemical and biological defense on a global basis.

We have multiple interagency partners. For chemical and biological programs in the physical sciences, we have nine projects being worked for the CBDP by the DARPA; the performance standardization projects for biological sampling methods and polymerase chain reaction assay equivalency with the Center for Disease Control and the DHS; and the Biomonitoring Memorandum of Understanding governing development of a coordinated environmental biological weapon surveillance architecture with the DHS, United States Postal Service, the HHS, and the Environmental Protection Agency. .For chemical, biological, radiological and nuclear medical systems we are working with the DARPA to shorten development time and decrease the costs of vaccine development, and with HHS to form a Joint National Stockpile for fielded products and continued collaboration on numerous developmental products. As previously noted, a joint stockpile currently exists for the smallpox vaccine and one is being developed for the anthrax vaccine.

We have contracts with over 100 large and small companies located across the United States. Industry is a key partner in our efforts both to exploit technological opportunities and to rapidly field commercial off-the-shelf capabilities. We work with the joint science and technology office to regularly incorporate opportunities for industry to demonstrate their most advanced products within the construct of Technology Demonstration Assessments and Technology Demonstration Evaluations.

Federal, State, and local collaboration (Military-Civil Integration) can mitigate the new threat relationships and the new concept of security

In additional to our national partnerships with the DHS and other Federal agencies, we have strengthened our partnerships with other Federal, state and local agencies ensuring our military installations are prepared to mutually support and interoperate with the civilian communities in which they reside. We have already mentioned our partnership with the BioWatch Program and how that has fostered strong relationships between local BioWatch decision-makers and their neighboring military installations. The common alerting protocol allows a warning message to be consistently disseminated simultaneously over many warning systems to many applications. Improving information sharing and management is a critical component our efforts to better integrate with the local community to ensure a coordinated and effective response.

We have made steady and significant progress in military-civilian coordination efforts. Interoperability between DOD and civilian capabilities are paramount to national security. Our strategy is to enable and facilitate coordinated preparedness planning activities, working collaboratively with our civilian counterparts to maximize the efficiency and effectiveness of both our military and civilian assets. We must collectively ensure that the capabilities we deploy are not only adequate, comprehensive and scalable but also complementary and coordinated, to ensure the protection of our most precious assets, our military and civilian citizens.

5. CHALLENGES

We are facing a long-term threat that poses significant challenges to our success. I would like to provide details on several key points.

Stand-Off Detection

Stand-off identification of chemical and biological agents remains a fundamentally difficult problem. We are pursuing several advanced technologies to improve performance, but stand-off technologies are unlikely to provide the same fidelity of information that the technology used in point sensors can. To mitigate this inherent

shortcoming, we are using point and stand-off sensors together, combining the early warning strength of stand-off detection with the fidelity of point sensing.

Technology Development for Decontamination

There are a range of technical challenges associated with chemical, biological, radiological, and nuclear decontamination. Our warfighters need decontaminants that are safe for sensitive equipment, do not require an extensive logistic footprint, able to decontaminate a broad spectrum of agents, are environmentally safe, and pose no unacceptable health hazards. New technology developments are required to provide decontamination systems that effectively clean all surfaces and materials while simultaneously reducing the manpower and logistics burden. Especially challenging is a single all-hazard decontamination solution that eliminates all threats while not damaging materials such as plastics, fabrics, and composites.

"All-Hazards" Capabilities

Many factors drive us toward providing our warfighters the full range of protection, detection and decontamination capabilities against "all-hazards." By "all-hazards" I mean that the threat can come from an adversary's use of traditional chemical warfare agents, advanced/future chemical agents and biological warfare agents, or even toxic industrial chemicals. These threats can come from state actors, terrorists, or the individual. "All-hazards" can include the effects of intentional and unintentional releases of hazardous materials to include natural disasters. These types of threats can be encountered at home or abroad and in a hostile or benign environment. All of these variables significantly challenge our technology requirements.

Synchronization of Information Systems with Service Oriented Architecture

Chemical, biological, radiological, and nuclear information systems are evolving to enable automatic collection and fusion of information from all chemical, biological, radiological, and nuclear defense assets throughout the battle space, and integrate that data. A significant challenge is to integrate relevant information into the Services information systems and architectures.

Maintaining the Industrial Base Capabilities

The chemical and biological defense industrial base is characterized as small niche defense-centric sectors embedded in larger commercially dominant industries such as materials, textiles, pharmaceuticals, and electronic equipment. The ability to maintain a healthy industrial base—commercial and organic—capable of responding to wartime surge requirements is a challenge and we work closely with our Service partners, the Defense Logistics Agency, the Defense Management Contract Agency, and others to proactively identify, plan for, and execute strategies that ensure we maintain vital industrial base capabilities.

Food and Drug Administration and Bio-surety Regulations

All CBDP medical products, by law, must be FDA approved. The FDA regulatory process is complex, with increasing development costs and schedules due to many factors, including: additional studies required to maintain compliance with FDA regulations, increasing cost of research tools and increasing clinical trial size and complexity. In spite of these industry-wide challenges, CBDP medical programs remain competitive with industry benchmarks in obtaining FDA approval for medical countermeasures.

Policy for the Selling of DOD Equipment to Civil Authorities

We are working with the Office of Federal Procurement Policy to facilitate the sales of equipment developed for DOD to civil authorities in accordance with the National Defense Authorization Act for Fiscal Year 2004.

Common Test and Performance Standards

Common test and performance standards across agencies and operational areas continue to challenge the efficient use of technology and impede interoperability. We are working with Federal, State, and local agencies through the interagency board to develop these common standards.

Urban Environment

The urban environment contains many unique challenges to providing WMD protection or consequence management capability. The raw materials present in any urban environment include a broad array of chemicals, to include toxic industrial chemicals. The urban environment also has very localized atmospheric conditions with a great degree of variance across the urban landscape due to differences in infrastructure height, density and throughways. We are working to overcome these challenges with detectors, protective equipment and decontamination equipment

that possess both a conventional warfare agent and a toxic industrial chemical capability. We are also working to upgrade our decision support tools to account for the unique atmospheric conditions present in an urban environment and how those conditions influence the spread of hazards within that environment.

Funding

Our capability development must keep pace with the rapid advances in science, which directly influence the scope and structure of threat agents. To do this we must put adequate funding in place to ensure our capability matches this fast changing and uncertain environment.

6. SUMMARY

Mr. Chairman and distinguished subcommittee members, I would like to thank you for allowing me to provide this written testimony. Your continued support of the chemical biological defense program is crucial for our military and nation to succeed in the face of a chemical or biological attack. We have been successful in fielding equipment and pharmaceuticals over the last several years to counter the current chemical and biological threat. We fully recognize that even the smallest use of a chemical, biological, radiological, or nuclear weapon can create an environment of instability, doubt and fear among our allies and citizens at home and we are deploying interoperable systems at our installations worldwide to address this threat. We are in the process of developing broad-spectrum technologies that we will integrate into a system of systems to counter the evolving threat. We are working closely with our interagency partners to defend the homeland. With your guidance and assistance, together, we are bringing future technologies forward to protect our military and the Nation against the chemical, biological, radiological, and nuclear threat.

Senator REED. Thank you very much, General.

Dr. Cerveny?

STATEMENT OF DR. T. JAN CERVENY, ASSISTANT DEPUTY ADMINISTRATOR FOR NONPROLIFERATION RESEARCH AND ENGINEERING, NATIONAL NUCLEAR SECURITY ADMINISTRATION, DEPARTMENT OF ENERGY

Dr. CERVENY. Good afternoon, Chairman Reed, Senator Dole.

I am pleased to be here this afternoon to testify on behalf of NNSA to your subcommittee on the critical nature of work underway in NNSA and how we work closely with other executive branch organizations, many of which are represented in this hearing room, to advance the nonproliferation objectives of this Nation.

Acquisition of WMDs by rogue states or terrorists stands as one of the most potent threats to the United States and international security. The continued pursuit of nuclear weapons by terrorists and states of concern underscores the urgency of NNSA's defense nuclear nonproliferation efforts to secure vulnerable nuclear weapons and weapons-usable nuclear materials, to detect and interdict nuclear and radiological materials and WMD-related equipment, to halt the production of fissile material, and, ultimately, to dispose of surplus weapons-usable materials.

Our Office of Nonproliferation R&D supports NNSA programmatic missions by providing innovative technology and scientific advice. The core mission of the Office of Nonproliferation R&D is to develop the next generation of nuclear nonproliferation sensors and detection capabilities, as you stated earlier.

We execute our programs through a variety of high-tech institutions and organizations, such as leading universities, small businesses, industry, and, most importantly, the U.S. national laboratories. The laboratories are truly our go-to guys for unique, cutting-

edge R&D, and they play a critical role in transitioning our technology into operational systems and platforms.

Our programs focus on providing long-term, stable guidance and funding for R&D through two primary programmatic offices—Proliferation Detection, or pre-detonation or pre-boom, and Nuclear Detonation Detection (NDD), or post-detonation, post-boom.

Proliferation Detection focuses R&D resources on detection of foreign production of highly enriched uranium, detection of foreign production of plutonium, and advancing the state-of-the-art for detection of illicit movement of enriched uranium or plutonium or special nuclear materials, as we call them.

These mission areas are supported by enabling technology development in areas like remote sensing, as in our display, advanced radiation detection materials, and simulation algorithms and modeling. Further, we have a robust test and evaluation program focused on ensuring that new technologies are suitable for transitioning to our operational partners.

The other office in my area, NDD, the post-boom piece, provides the operational systems and know-how to detect nuclear detonations anywhere in the world, 24/7, 365 days, whether they are underground, in the atmosphere, or in space. NDD also develops the tools, technologies, and science related to collecting and analyzing forensic information gathered after a nuclear detonation in conjunction with the work of DHS and DTRA.

I would like to turn now to NNSA's longstanding close and collegial relationship with DOD, specifically the DTRA. I am pleased to be here testifying with my colleague, Dr. Tegnelia of DTRA. DTRA and NNSA, as well as our collective predecessor organizations, have nearly 60 years of close technical cooperation.

From the earliest days of the Manhattan Project through the nuclear testing era of the Cold War and into our current programs to counter the threat of WMD, we have enjoyed a healthy and continuous set of joint programs. A key premise of the NNSA nonproliferation R&D program is that research projects may have many different users, those within NNSA, the DOD agencies, the military Services, the Director of National Intelligence (DNI) agencies, and/or DHS agencies.

We concentrate on advancing the fundamental state-of-the-art in the particular technology area and then pass that technical capability on to a user for incorporation into a specific piece of equipment or a specific concept of operation.

In the case of DOD, this often means a close association not only with the R&D components of the various DOD organizations, but also with the operational components of DOD.

Turning to our continuing interactions with other Government agencies, I would like to highlight a four-way memorandum of understanding (MOU) with NNSA, DTRA, the Domestic Nuclear Detection Office from DHS, and the DNI's Science and Technology (S&T) Office, wherein we coordinate our radiation detection R&D programs. Not only do we review each other's research proposals jointly, we sit on merit review committees for each other's programs annually and thus benefit from this very close collaboration of knowing what each other is doing.

We collectively work to ensure that duplication of effort across the agencies is minimized. But more importantly, we bring significantly more resources, emphasis, and senior attention to bear on the areas critical to national and homeland security.

All of the projects on our display today that I believe both of you had the opportunity to see have been either developed in conjunction with DTRA or with DTRA's DOD customer set in mind. These projects were consciously focused to meet operational needs and requirements.

In conclusion, I have provided but a few highlights of our program and touched upon the collaborative interface and interactions our program has shared with other Federal partners. We continue to serve as a primary long-term investor into nuclear nonproliferation R&D technologies to keep our national and homeland security operational associates on the cutting edge.

In summary, I would like to thank the subcommittee for this opportunity to provide information on the critical nuclear nonproliferation-related R&D underway at NNSA and the ways we link this work with partner organizations.

With that said, I am happy to answer any questions.

[The prepared statement of Dr. Cerveny follows:]

Prepared Statement by Dr. T. Jan Cerveny

Good afternoon Mr. Chairman, distinguished members of the subcommittee. I am pleased to be here this afternoon to testify on behalf of National Nuclear Security Administration (NNSA) to your subcommittee on the critical nature of the work underway in NNSA and how we work closely with other executive branch organizations, many of which are represented in this hearing room, to advance the nonproliferation objectives of the Nation.

I. INTRODUCTION

Acquisition of nuclear and other weapons of mass destruction (WMD) and related technologies, equipment and expertise by rogue states or terrorists stands as one of the most potent threats to the United States and international security. The continued pursuit of nuclear weapons by terrorists and states of concern underscores the urgency of NNSA's efforts to secure vulnerable nuclear weapons and weapons-usable nuclear materials, to detect and interdict nuclear and radiological materials and WMD-related equipment, to halt the production of fissile material, and ultimately, to dispose of surplus weapons-usable materials.

NNSA supports the nonproliferation goals of the Nation through a broad collection of programs. The Defense Nuclear Nonproliferation mission is to detect, secure and dispose of dangerous nuclear and radiological materials. To implement this mission, the Office of Defense Nuclear Nonproliferation secures civil nuclear and radiological materials worldwide; helps to secure Russian nuclear weapons material; detects and deters illicit international nuclear transfers; strengthens and works to universalize international nonproliferation efforts; eliminates weapons-usable material; and conducts cutting-edge research and development (R&D). Some examples of these programs include removing or securing nuclear materials in the former Soviet Union; installing radiation detection monitors and capabilities at major border crossings and seaports around the world—known as the Second Line of Defense program; and programs such as the Global Threat Reduction Initiative (GTRI) aimed at removing proliferation-sensitive radioactive sources both domestically and overseas. Our Office of Nonproliferation R&D supports the various NNSA programmatic missions by providing innovative technology and scientific advice.

II. NONPROLIFERATION RESEARCH AND DEVELOPMENT

The core mission of the Office of Nonproliferation R&D is to develop the next generation of nuclear nonproliferation sensors and detection capabilities. We execute our programs through a variety of high-tech institutions and organizations, such as leading research universities, small businesses, industry, and, most importantly, the U.S. National Laboratories.

I cannot emphasize enough the importance of the National Labs to the research base for national and homeland security. The National Laboratory system has provided the critical infrastructure and technical expertise for Nonproliferation R&D for over a half century. While we supplement and complement our programs at the National Laboratories with research at universities, small businesses, and industry, the Laboratories are truly our "go to guys" for unique, cutting-edge R&D. Additionally, the Labs are critical to the transition of our technology into partner agency operational systems and platforms.

The programs of the Office of Nonproliferation R&D focus on providing long-term, stable guidance and funding to the community of researchers that provides the core of new nuclear detection technologies. We accomplish our R&D mission through two primary programmatic offices: Proliferation Detection and Nuclear Detonation Detection. The emphasis is on developing the vital technologies to detect and deter nuclear proliferation, and should detection/deterrence fail, we stand ready to meet U.S. nuclear detonation detection goals with technology used to characterize a domestic nuclear attack.

Proliferation Detection Research and Development

The first program, Proliferation Detection, focuses R&D resources within three primary mission areas. These include: 1) detection of foreign production of highly enriched uranium, 2) detection of foreign production of plutonium, and 3) detection of enriched uranium or plutonium being moved or transported—radiation detection technology focused on advancing the state-of-the-art to detect illicit movement of these special nuclear materials. The three mission areas are supported by "enabling" technology development in areas like remote sensing, advanced radiation detection materials, and simulation, algorithms, and modeling. Further, the proliferation detection program has a robust test and evaluation program focused on ensuring that new technologies are suitable for transitioning to the operational communities. Undergirding all this work is a final research area focused on creating a fundamental library of physical features (chemical, radiological, and spectral) of the "Signatures and Observables" expected from any foreign nuclear production program, which in turn provides a basis for developing new detector capability through either the mission or enabling technology research areas.

Nuclear Detonation Detection Research and development

Our second program is Nuclear Detonation Detection. This program has three primary mission areas: 1) manufacture of the Nation's operational space-based nuclear detonation detection sensors, which are integrated onto and operated by the U.S. Air Force on the Nation's GPS and high altitude space systems; 2) development of the next generation of the Nation's ground-based nuclear detection capabilities such as seismic detection, hydroacoustics, and infrasound—again integrated into and operated by U.S. Air Force components; and 3) development of the tools, technologies, and science related to collecting and analyzing the forensic information gathered from a nuclear detonation. The capabilities of the nuclear detonation detection R&D program are based upon decades of experience gained through the instrumentation of the U.S. nuclear testing program. The systems we develop for the Air Force have been, and continue to be, a major component of the U.S. ability to monitor the globe on the ground, from the air, and in space, 24x7, 365 days per year for foreign nuclear detonations.

The 2006 North Korean test of a nuclear device provides the most recent example of the efficacy of the cutting-edge technology we provide the Air Force for this U.S. program. In this case, the ground-based mission area of the research program had just delivered a major analysis software upgrade from Sandia, Los Alamos, and Lawrence Livermore National Laboratories to the Air Force. This new upgrade enhanced the Air Force's capability for geo-locating and discriminating an underground nuclear blast using seismic measurements, thus improving the speed and accuracy of information provided to national decision makers regarding the location, magnitude, and type of nuclear test.

III. COORDINATION WITH DOD AND OTHER FEDERAL AGENCIES

I would like to turn now to NNSA's longstanding, close, and collegial relationship with the Department of Defense, specifically the Defense Threat Reduction Agency (DTRA). I am pleased to be here testifying with Dr. Tegnelia. DTRA and NNSA, as well as our collective predecessor organizations, have nearly 60 years of close technical cooperation. From the earliest days of the Manhattan Project, through the nuclear testing era of the Cold War, and into our current programs to maintain the U.S. nuclear stockpile and counter the threat of nuclear proliferation, we have en-

joyed a healthy and continuous set of joint programs. I will concentrate specifically on R&D programs devoted to nuclear nonproliferation.

A key premise of the NNSA Nonproliferation R&D program is that the ultimate outcome of any research project may have many different users—those within NNSA, the Department of Defense (DOD) agencies, the Military Services, the Director of National Intelligence (DNI) agencies, and/or the Department of Homeland Security agencies. Therefore, we concentrate on advancing the fundamental state-of-the-art in a particular technology area, and then pass that technical capability on to a user for incorporation into a specific piece of equipment or concept of operation that complements their mission. In the case of DOD, this often means a close association with not only the R&D components of the various DOD organizations, but also with the operational components of DOD.

It is not uncommon for the scientists and engineers from our programs at the national laboratories to be testing new equipment at locations and in conditions that are not "ideal" from a lab bench researcher's perspective. A recent example includes several researchers from Los Alamos National Laboratory conducting validation experiments of a low-light imaging camera in the tropical jungles of Central America, while accompanying a military unit. This new technology has the potential, along with other possible uses, to track movement beneath the thick jungle canopy throughout the equatorial regions of the world. While this technology was developed primarily for discovering or tracking the movement of nuclear proliferation activities, it could potentially be used for counternarcotic or counterterrorism operations. I mention this specific example because it illustrates the collaborative relationship we in the NNSA Nonproliferation R&D office share with our partners to link our research to real world needs, such as the larger DOD. The camera is on display in the back of the hearing room.

IV. INTERAGENCY COLLABORATION

Turning to our continuing interactions with other government agencies, I'd like to highlight some of our collaborative efforts in advancing the Nation's capabilities to detect nuclear material. NNSA, under a Memorandum of Agreement with DTRA, the Department of Homeland Security's Domestic Nuclear Detection Office (DNDO), and the DNI's Science and Technology Office, has integrated our R&D programs devoted to radiation detection. Not only do we review research proposals jointly, we sit on the merit review committees for each agency's programs, and thus benefit from this close collaboration. We collectively work to ensure that duplication of effort across agencies is minimized, but, more importantly, bring significantly more resources, emphasis, and senior attention to bear on areas critical to national security.

Our long-term R&D program funds a wide array of cutting-edge technologies. I have select examples of radiation detection R&D and technologies under development on display in the back of the hearing room. In particular, we have one on display that we share with DTRA. We are presenting a video of the technology on a laptop, while DTRA is displaying the hardware for the Airborne Radiological Debris Collection System (ARCS) developed by Sandia National Laboratories. This smaller, lighter, lower power technology collects particulate debris from an airborne platform (manned or unmanned) to bring back for analysis. It provides significantly improved capability over current bulky, heavy, higher power debris collection systems. Since it's integrated into a pod, it more flexibly accommodates multiple deployment platforms.

All of the projects in our display have been either developed in conjunction with DTRA, or with DTRA's DOD customer set in mind, and consciously focused to meet operational needs and requirements.

V. OTHER TECHNOLOGY EXAMPLES

I would like to draw your attention to another project that has significant potential in the proliferation detection realm. Pacific Northwest National Laboratory (PNNL) is developing a new type of hand-held radiation detector called the Pixilated Cadmium-Zinc-Telluride Detector. This detector uses a small group of crystals ganged together in an array to provide nuclear direction finding and identification capabilities not currently seen in commercial or military equipment. This technique of combining small, high purity crystals into an array was developed to overcome the problems of larger crystals cracking or containing inclusions that significantly impair their detection capabilities.

Lawrence Livermore National Laboratory created the R&D 100 Award—winning technology called the Sonoma Persistent Surveillance System, which offers the first integrated, broad-area, high-resolution, real-time motion tracking system for surveil-

lance applications. Sonoma is unique in its ability to provide continuous, real-time video of an area the size of a small city with resolutions sufficient to track up to 8,000 moving objects for applications such as monitoring traffic, special events, border security, and harbors. Sonoma's novel imaging technologies and real-time processing have generated numerous government program spin-offs, and initial capabilities have been transferred directly to other government partners. During the past year, there have been several inquiries about technology transfer and the potential commercialization of the Sonoma system and its associated technologies, since it is expected to cost about one-tenth the price of comparably sized tracking systems.

VI. CONCLUSION

I have provided but a few highlights of our program and touched upon the collaborative interface and interactions our program has shared with DTRA and our other Federal partners. We continue to serve as a primary long-term investor into nonproliferation R&D technologies to keep our national and homeland security operational associates on the cutting-edge.

In summary, I would like to thank the committee for this opportunity to provide information on the critical nuclear nonproliferation-related R&D underway at NNSA and the ways that we link this work with partner organizations. I look forward to answering any of your questions.

Senator REED. Thank you very much, Dr. Cerveny.

I want to thank the witnesses for their excellent testimony. I also want to thank all of your colleagues, some that are here today and some that are across the globe, for the work they do. Not only are they employees of DOD and DOE, but also civilian contractors who work with you. They provide extraordinary advantage to us as we confront these serious problems.

I would like to ask a few questions, then recognize my colleague. I would assume also the opportunity to do a second round, too. It was excellent testimony. You have laid out several serious challenges, and I just wonder if each of you could respond because of your experience. What is the issue that causes you most concern? Some have already highlighted in your initial remarks, but you might want to emphasize it or provide additional perspective.

Also if you were to advise this subcommittee, which, in fact, you are, what should we focus on? What should we be making sure gets done throughout the research structure? Dr. Tegnelia?

Dr. TEGNELIA. There is this question, which is usually asked of our leaders: what keeps you up at night or what is your worst nightmare? I would second the thought, as I indicated in my testimony, that it is a loose nuclear weapon in a city in the United States. I would just suggest that. I think that is today's current problem.

I just would reiterate, I think you have heard testimony on this before, that the expansion of the Nunn-Lugar program to help prevent that kind of danger is maybe the most important function that we are performing today.

For the future, I think the problem that General Reeves and I discussed, which is the advancing of biological sciences and the potential for advanced biological threats is the threat of the future.

Again, I would suggest to you that in addition to R&D, you have heard some ideas, I think, in testimony about the idea of expanding Nunn-Lugar to be able to do worldwide prevention of these kinds of problems, and the idea of migrating biological defense tools worldwide, I think, would be a very valuable thing.

So, in summary, today it is the nuclear problem, and tomorrow, it could be the biological problem.

Senator REED. Thank you.

Major General Reeves?

General REEVES. Thank you, Mr. Chairman.

I would certainly second for the future threat what Dr. Tegnelia just mentioned. It is the biological threat that potentially concerns us the most. As you may know, 4 years ago, a university in New York, simply by ordering strands of deoxyribonucleic acid (DNA) on the Internet, put together a polio virus. Just a few weeks ago, a California firm announced that they had created the first synthetic bacteria.

Things that are being done today in high schools, in colleges just a few years ago were only done by post-doctorate students. That is how fast the biological sciences are advancing, and so that certainly concerns us the most.

In the near-term, our experience with the terrorist threat in DOD is that it is strategically sophisticated, but tactically very simple. They use what is available, and what is most predominantly available are toxic industrial chemicals. I know Congress is currently taking action on securing the U.S. chemical industry, and I certainly applaud those actions.

As we look at where we need to do additional research, particularly in understanding the performance of these toxic industrial chemicals to protect our force is where we are focusing some of our efforts. Let me just give you a very simple example.

Many of the models you have seen that show what happens when a chemical starts to proliferate through an urban area or over open terrain simply models that chemical. Take something like boron trifluoride, which is a common chemical that is used in the semiconductor industry.

When that chemical hits the air, it changes. It changes into hydrogen chloride. It changes into an acid. Models don't accommodate for those changes. It has different performance characteristics. So we need to go through literally our entire inventory of equipment to look at how do we deal with those threats, and how do we provide immediate and near-term protection for our force?

Senator REED. Thank you. I want to ask the same question of Dr. Cerveny. But if I may follow up, essentially, the barriers—as you have said, to entry to the biological business are much lower than the nuclear business.

General REEVES. Yes, sir.

Senator REED. The model and the mindset we have applied to nuclear deterrence and nuclear nonproliferation might not be adequate because, again, it seems everybody can get in this business of biological or chemicals, and it raises the question of even if we are innovative and improvise very well, can we keep up?

You might comment, then I will recognize Dr. Cerveny. Do you have a sense—this is a different dynamic than the nuclear situation?

General REEVES. It certainly is, and I think what you have to do is look at how do you go about developing the tools for rapid broad-based identification of these threats. That is exactly where we are focusing our efforts right now. We are focusing them on things like genetic sequencing and bio informatics.

How do we leverage the mega technologies of information technology and biotechnology to, first, develop a platform so that we can identify what is going on? Second, you have to develop a very rapid means of developing a countermeasure and then ultimately producing that countermeasure.

That is a lot of what the TMTI is all about, is the identification and having prepositioned, if you will, platform technologies that we can rapidly build on to develop countermeasures and, with our partners in DARPA, developing the manufacturing capabilities to rapidly produce the countermeasure.

Senator REED. Thank you, General Reeves.

Dr. Cerveny, the larger question was, as Dr. Tegnelia said, what keeps you up at night?

Dr. CERVENY. The concerns that I have, have to do with the three major missions that we have to ensure that we can try to accomplish them. One is to look at the nuclear fuel cycle and try to find those who may be trying to proliferate. That is a big issue for us.

In addition, if we miss that and it does get into a weapon system, we want to be able to find that weapon system. Then, God forbid, it should go to the end and a nuclear weapon that is already full-up gets stolen and detonated somewhere. We want to be able to do the aftermath, detection of what is going on, to be able to do all the forensics associated with that. So those are my three major areas of concern.

Senator REED. Following up on that, Dr. Cerveny and Dr. Tegnelia, the National Security Presidential Directive (NSPD)–17 and Homeland Security Presidential Directive (HSPD)–4 assigned nuclear forensic and attribution responsibilities across the executive branch. Could you comment on essentially your responsibilities and how this is proceeding, the coordination process? If you could start, Dr. Cerveny?

Dr. CERVENY. I am doing some of the research at the front end. So I have transitioned that both to DTRA as well as to the FBI as well as DOD and/or other components of DHS.

Senator REED. Dr. Tegnelia?

Dr. TEGNELIA. Sir, NSPD–17 and HSPD–4 basically indicated that DHS was the lead in the attribution and forensics capability. It works with the Intelligence Community (IC), which has the responsibility to provide the information for decisions.

DHS broke that activity up into two pieces. One was pre-detonation and one was post-detonation. DTRA is responsible for worldwide post-detonation collection of the debris for analysis. We work with DHS, as I mentioned, as the lead. We work with the DOE because their laboratories are the people who are going to do the analysis of these remains of a device and make the attribution as to who it is technically.

Then we also work with the FBI because the FBI has responsibility inside of the United States for the investigation of these types of devices. That is how the NSPD separates out the responsibilities.

Senator REED. One follow-up question, Dr. Cerveny, and then I will recognize Senator Dole. I do have more questions for the whole panel.

But this attribution process assumes that you have a database, which you can match up, that you can, in fact, identify and attribute to an entity or country. How are we doing on that database creation?

Dr. CERVENY. That database creation, I believe you are talking about the Nuclear Materials Information Program that is being created by the IC? Is that what I presume you are saying?

Senator REED. I am just generally talking about from your perspective because you were doing research to identify materiel, but then you have to match it up with something. I am asking from your perspective, how is that something coming, I guess?

Dr. CERVENY. Exactly. From the testing era, when we had the Cold War testing era, there is quite a bit of data from there from the Russians and from us, from our testing itself. What we do with that is match against that.

Some of the newer stuff that the proliferants may be trying to make is going to be a bigger challenge for us because there is no database on that.

Senator REED. Any other comments? Dr. Tegnelia?

Dr. TEGNELIA. I guess I would add to that that the subject of broadening that database is under active pursuit by the IC, and at least my experience is they are paying full attention to trying to do what you are suggesting.

Senator REED. Thank you very much.

Senator Dole.

Senator DOLE. Thank you, Mr. Chairman.

Dr. Tegnelia and General Reeves, let me ask you about a March 2007 report by the DOD Inspector General (IG). It was highly critical of the DOD's coordination and management of its combating WMD program. The report's main recommendations were for the DOD to better coordinate the work of 40 offices involved with combating WMD, establish a process to measure performance, clearly identify the use of the funds budgeted for the program throughout the Department, and propose legislation requiring that the Federal agencies involved in combating WMD coordinate with one another.

Could you give me your assessments of the IG report and what steps has the DOD, including your own organization, taken in response to the IG report? Could we start with you, Doctor, and then, General Reeves, ask you to respond?

Dr. TEGNELIA. Yes, ma'am. As you indicated, there were two elements of the report. The first, there were 40 organizations who were all dealing with WMD. I would suggest to you that the report was written with data that was done in 2005, and a lot has happened since 2005 to address the issue that you are concerned about.

I would suggest to you that having a reasonable number of organizations concerned with WMD is a strength, not a weakness. For example, there are 50 civil support teams, all of which are trained to handle WMD. So having a reasonable number of organizations concerned with WMD is a strength, not a weakness.

The problem is to make sure that they are all working together and on the same page. What has happened since that time is the formation of the STRATCOM as the lead combatant command for combating WMD. It is that command's responsibility to get all of

these units working together, working in concert to be able to help both local communities and so on through Northern Command (NORTHCOM), and also our allies in the process of doing that.

So my sense is that the situation has changed significantly since STRATCOM has been on the scene in trying to help orchestrate the problems that that report indicated.

Senator DOLE. Thank you.

General Reeves?

General REEVES. Ma'am, I would second that and add to STRATCOM, NORTHCOM as well. Those two major commands between the homeland defense mission and the larger civil support mission, have helped consolidate a number of the activities.

As you indicated earlier, in the case of the research, development, and acquisition of equipment, that has, in fact, all been consolidated under a single office and that has been an ongoing program now for a number of years, which we continue to have a very robust single chain of command, if you will, to execute that program.

Senator DOLE. Thank you.

Dr. Cerveny, with the aging and gradual passing of the Manhattan Project generation of nuclear scientists, our Nation is facing a loss of scientific expertise in the nuclear field that will be hard to replace. Recent studies highlighted the need to replace the retiring generation of scientists who have the skills to contribute to the field of nuclear forensics through which scientists can discern the age and origin of nuclear materials.

Are you finding that this loss of expertise is a problem the R&D programs are experiencing under your purview?

Dr. CERVENY. It is starting to happen, Senator Dole. Within 5 years, we are probably going to have a pretty serious impact because of, as you said, the age that these folks are becoming. They are ready to retire now.

There are younger ones that are coming into the fold. I don't want to in any way denigrate them, but they don't have the experience of any of the testing that we have done or even the Manhattan Project type of information that those senior scientists have available in their brains.

The younger ones are bright, no doubt about it. But lacking that experience and finding a way to maybe hook a wire to the older guys who are retiring heads and do a data dump into the younger folks would be wonderful. But it is very difficult to find, and we are working hard on that with the laboratory community to ensure we do get some of that transition occurring. It is a challenge.

I did read the report that you are talking about, the National Academy of Science (NAS) report. It was quite sobering to read that.

Senator DOLE. Right. Yes, and I wonder if there is anything this subcommittee could do to be helpful? Perhaps by authorizing some kind of fellowship program to attract young scientists, more young scientists to the disciplines where you foresee shortfalls? I understand what you are saying about the degree of expertise, but in general, do you think there is a need to just attract more young people into this area, and could we be of any help in that respect?

Dr. CERVENY. From the standpoint of do we need to attract more? Yes, and we are working very hard on that. In fact, it is interesting you should ask. We had a conversation with our laboratory partners yesterday about how we could do this, if we could develop fellowships or establish fellowships to encourage them to potentially come into the laboratory for a short timeframe and then rotate into the Washington office here in D.C. to get the flavor of what is going on from the overall standpoint.

So we are working on doing those sorts of things. Maybe not to the degree that you are interested in, but we are definitely working on trying to make that happen.

Senator DOLE. Okay, thank you.

General Reeves, how would you characterize our technical progress in improving the accuracy of our sensors, both detection of agents and reduction of false positives. What are the major technical challenges which remain to be solved in the area of sensor technology?

General REEVES. There are really two major areas. One has to do with stand-off technology, which is clearly extremely problematic. In order to identify an agent, be it chemical, biological, or radiological—presents a large variety of issues with atmospherics, the type of sensor, and literally where you can use that sensor.

The second major issue we have is in, as you point out, false alarms, which is sensitivity and selectivity. That has gotten progressively better and, I would argue, almost exponentially better over the last few years. In June of this year, because there has been so much work not only within the Government, but also by private industry in this area, we will be holding a technology readiness evaluation at Dugway Proving Grounds, where we will allow both laboratories, within DOD and outside of DOD, and private industry to come to Dugway to demonstrate their capabilities and then independently evaluate their technology readiness levels.

It is our view that they have gotten significantly better, that we can reduce our own investment to some degree for point sensors in the biological detection area and leverage good work that has already been done in lots of other areas. So it is actually a cost avoidance to us.

Senator DOLE. Thank you.

Thank you, Mr. Chairman.

Senator REED. Thank you very much, Senator Dole.

Dr. Tegnelia, in your comments, you said that local responders are proficient in handling a low-yield incident, but that there is a gap with high-yield incidents. How difficult it is relative to a low-yield to stage a high-yield, that is, if the high-yield is something of a probability of 1 percent, then that gap is not as worrisome if that probability is something closer to 50 percent.

Can you give us an idea in this session of how much we have to worry about that lack of capability?

Dr. TEGNELIA. I was thinking about that question, and it is an important question. I would just tell you that in an open hearing, it is hard to discuss that specifically. But we are thinking about the question that you are concerned about.

Senator REED. Fine, fine. It is an important question.

Dr. TEGNELIA. Yes, sir.

Senator REED. It has to be handled in a more confidential manner.

Let me ask all of you because one of the issues that perennially arises when you develop technology is getting it into the hands of the field workers, the people out there that actually do it. Can you give us a notion of how you think we are doing in transitioning technology? What are the chokepoints that we have to worry about? I will ask each witness.

Dr. Tegnelia?

Dr. TEGNELIA. My perspective, sir, is that the military mission of combating WMD is a relatively new operational responsibility for the DOD. We have just put together the national strategy and the military strategy for combating WMD, and we are now in the process of beginning to field capabilities not only with the individual soldier, which General Reeves spends a lot of time on, but also unit capabilities to handle the missions of WMD.

We have done something which I think is extremely important as a lesson learned from Iraq, and that is how would you eliminate chemical, biological, or nuclear weapons should you encounter them on the battlefield? Very important problem. Something we were concerned about in Iraq.

We have fielded a capability now through STRATCOM, that could help in South Korea. It is actually deployed now in Iraq, eliminating these kinds of weapons from the battlefield. That is a new capability. It is a brand-new thing that has been developed.

Another example of that is fielding an attribution capability, which the NSPD, as you pointed out, is just now calling for. So these new units are coming online through STRATCOM, and they are being deployed to our combatant commanders, including NORTHCOM. We are beginning to exercise with them, and we are beginning to build the capability. So we are started, but we have a long way to go.

This is, as I indicated, a new mission, and it is now beginning to get the emphasis to field this kind of capability.

Senator REED. Thank you.

General Reeves?

General REEVES. Sir, in the chem/bio defense program, we do three things. First, we have a formal process to ensure that our investments in S&T transition to advanced development. We use something called technology transition agreements, which are a formal agreement between the S&T developer and one of my project managers to ensure that they are mutually understanding what that technology is, and they are ready to accept it, and we have put the resources in place to use it.

Second, we conduct quarterly reviews.

Third, on a biannual basis, our joint staff looks at the roadmaps to ensure that those investments are reaching to advanced development and to procurement.

The second thing we do, as I mentioned a moment ago, are technology readiness evaluations, which are independently assessed, which gives laboratories and commercial industry the opportunity to demonstrate their technologies and what their technology readiness levels are. We use a formal process by an independent assessor to do that.

The third part, which is just now beginning, and I think it is an important initiative—and I would specifically compliment the Edgewood Chemical and Biological Center for doing this—is an educational component. One of the things we need to do with our researchers and scientists is to get them to understand that not all technology is necessarily good or useful. At some point, you have to look at technology from the standpoint of is it affordable? Can it be produced? Can you sustain it in the field?

They have developed a formal program to educate their basic research scientists to help think in those terms and use those kinds of filters before we make substantial investments in a technology we discover we can't use in the end.

Senator REED. Thank you.

Dr. Cerveny?

Dr. CERVENY. Thank you. For my program, we have instituted a whole host of things because a transition for a program that is a long-term R&D program is considered to be the valley of death that can occur for research technology that you develop and suddenly nobody is really interested in it.

What we have tried to do is include the operators and we actually do include the operators on the upfront of developing what our roadmaps are going to be and where we are going to go to ensure we have what their needs and requirements are. In some cases, that requires translation on our part because oftentimes our users don't know how to tell us in technical terms what it is that they want to be made better or lighter or more power-friendly.

So we have to be able to do that integration in between. Having the users on our committees for deciding what proposals are actually going to get funded in an area once we decide where we are going to go, then having them also in our annual program reviews for each of the 13 separate programs that we have, it has seemed to become very easy for us, as the ones that I showed you back here on our display table, the integration or the movement, transitioning those to the users has happened quite easily for us. They have actually been anxious to receive them.

Does that mean we have solved the entire problem? Not entirely. It is still a challenge for us, and we do many of the things that my two colleagues here have mentioned as well.

Senator REED. Thank you.

Dr. Cerveny, the budget request at NNSA for nonproliferation and verification in fiscal year 2009 is $275 million. That is $112 million below the fiscal year 2008 appropriation. That is a substantial reduction. What is not going to be accomplished as a result of that reduction?

Dr. CERVENY. The major difference there is the generosity of Congress when they passed the Omnibus and gave me the $112 million plus-up, which was very kind of them. What I did with it was place it into the prioritized areas that we have to ensure that we had full-up proposals funded.

The $275 million actually is level with the real 2008 request that we put in and the 2007 request. In 2010, I believe we are going to be going up, though that number has not been established yet for us.

Senator REED. The fiscal year 2009 budget eliminates a line called supporting activities. Can you describe what that is?

Dr. CERVENY. Yes, sir. The supporting activities was an unusual thing that was a leftover—I have been there for 4 years. It was a leftover, none of the other components of NNSA really showed such a thing. When I inquired what it was, it was really money that we transitioned into the two major programs that I discussed, the Proliferation Detection and NDD.

What I did was just transfer those functions that belonged to them into them. So nothing really vanished. It just moved to where it belonged.

Senator REED. I think Congress was persuaded that you needed the money, and I think we, given what I have heard today, I am no less persuaded. So it is a substantial reduction, and the activities, and you are going to have, I think, a challenging time to manage with all of the responsibilities with $100 million or so less.

Dr. CERVENY. That is correct. But we have tided folks over to ensure that we could use the generosity of Congress to cover them for a year or so, forward funding.

Senator REED. So we are sort of fasting for a year, but we are looking for something much better in the future?

Dr. CERVENY. No, I forward-funded specific projects to ensure that they had continuity to go to their conclusion.

Senator REED. You have also suggested that you would need additional funding in the succeeding budgets after 2009?

Dr. CERVENY. Yes. I believe we are going to be getting that. But I don't know right now. It has not been given to me yet.

Senator REED. Okay. Thanks. Let me yield to Senator Dole, if she has additional questions, and I have a couple more. Senator Dole?

Senator DOLE. Okay. I would like to ask Dr. Tegnelia and also General Reeves, do you need additional resources or authorities to more effectively carry out the technology R&D programs that we have been discussing here today? Do you have unfunded priorities in your program areas, so to speak? If so, what are they?

Dr. TEGNELIA. I think if I were able to ask you for additional funds for programs that we are doing, I guess I would give you two or three examples of things that are important. The first one is funding the expansion of the Nunn-Lugar program because it really is the forward defense on preventing a lot of these things from happening. The ability to extend that worldwide beyond the republics of the former Soviet Union would be a very important thing.

The second priority that I would give you, and I recall your question about young people—when your hair gets my color, you worry about the next generation of people who are coming along. I think there is a very simple thing that can be done to bring this next generation onboard, and that is fund the basic research programs that the Department is advocating.

That money ends up in the universities, and you can see behind you some of the examples that the universities are doing. In addition to getting good technology out, it introduces this topic to the people who are in school and ready to come out of school.

I would like to hope that the basic research money we put in would bring people into DTRA. If they were introduced to it and

they stayed in the field, that would be a win all by itself. So I would really suggest that you could help us a lot with funding the basic research program that we have.

The last comment that I would make to you is this idea of funding the research for the loose nuclear weapons activity and the international research on the nuclear detection of fissile material and the attribution activity, fielding attribution activity. Those things that are all related to the loose nuclear weapons, those are the kinds of things that I would accelerate.

Senator DOLE. All right. General Reeves?

General REEVES. Thank you, ma'am. We certainly have appreciated the subcommittee's support in the past on the TMTI, and we would ask simply that that funding remain constant.

Should additional funds become available, we would certainly like to apply funds towards advancing stand-off technologies, both in chemical and biological detection as well as looking at the next generation of chemical threats and biological threats, and finally at automating certain sampling processes, particularly for biological detection, which has a very broad-based application across our systems.

In the area of procurement, our services are particularly interested in rapidly fielding the next generation of protective masks which we have just produced called the Joint Service General Purpose Mask, as well as the next generation of chemical agent detectors, which, at the moment, are half the cost of the current detector. They are a quarter of the size, and they are a tenth of the weight. So they are very anxious to get them in the field.

We will be happy to provide the subcommittee a complete list.

[The information referred to follows:]

The U.S. Army has a list of underfunded priorities and is provided by the Special Assistant (Chemical and Biological Defense and Chemical Demilitarization Programs).

CBDP PRIORITY	UNFUNDED REQUIREMENTS	APPROPRIATION	P-1 ITEM OR R-2a PROJECT	FY09 (in 000s)
001	Joint Biological Standoff Detection System (JBSDS)	Procurement, DW	JC0250	28,000
002	Joint Biological Point Detection System (JBPDS)	Procurement, DW	JC0100	27,328
003	Joint Service General Purpose Mask (JSGPM)	Procurement, DW	JI0003	18,300
004	CBRN Small Project Acquisition Program (C-SPA) Modernization and COTS/ GOTS Refreshment	Procurement, DW	JS0004	12,400
005	Joint Service Personnel Decontamination System (JSPDS)	Procurement, DW	JD0055	3,600
006	Collective Protection System Backfit (CPS Backfit)	Procurement, DW	JN0014	5,600
007	Individual Protection Program (IPP)	Procurement, DW	JS0500	24,200
008	JSLIST Industrial Base	Procurement, DW	MA0400	50,000
	Procurement Total			169,428
001	Automated Sample Preparation for Biological Identification			
	Advanced Technology Development	RDT&E, DW	CB3	1,400
	Advanced Component Development & Prototypes	RDT&E, DW	MB4	3,500
002	NTA Detection/ Chemical Point Detection			
	Toxicology and Pharmicokinetic Studies	RDT&E, DW	CB2	3,000
	Provide TRL Six (6) capability	RDT&E, DW	CB3	11,700

	Handheld Detection of Liquids and Solids	RDT&E, DW	CA4	11,900
003	NTA T&E Facility Upgrades	RDT&E, DW	TE4	6,000
004	CB Distributed Early Warning System (CBDEWS)			
	Small Sensor Platform Development	RDT&E, DW	CB2	6,500
	LIDAR DISC/ DIAL	RDT&E, DW	CB3	10,000
	Hyper-Spectral/ Imaging Spectroscopy Acceleration	RDT&E, DW	CB3	5,000
005	CB Distributed Early Warning System (CBDEWS)			
	Active/ Passive Sensor Optimization Algorithm Development	RDT&E, DW	CA4	8,000
	Support Operational Demonstration	RDT&E, DW	CA5	1,800
006	Modular Mobile Lab	RDT&E, DW	CM5	14,000
007	National Bio-Monitoring/ Medical Surveillance	RDT&E, DW	MB5	13,500
008	All Hazards System-of-Systems Decontamination - S&T			
	Enabling Sciences	RDT&E, DW	CB2	4,500
	Energetic and Kinetic	RDT&E, DW	CB2	2,000
	Reactive Systems	RDT&E, DW	CB2	4,500
	Demonstrate Dual Use Capabilities	RDT&E, DW	CB3	12,000
	Traditional Approaches	RDT&E, DW	CB3	4,000
	Smart Systems	RDT&E, DW	CB3	3,000
	Self-Detoxifying Systems	RDT&E, DW	CB3	3,000
	Barrier Material	RDT&E, DW	CB3	4,000
	Enzymatic Approaches	RDT&E, DW	CB3	3,500
	Technology Readiness Assessment (TRA)	RDT&E, DW	DE4	4,000
009	Information Systems Enhancements (cognitive thinking and decision support)	RDT&E, DW	IS4	12,600
010	CBDP Integration into MDAP	RDT&E, DW	CA4	5,800
011	Advanced Bio-Identification Technology Upgrade to Joint Portal Shield	RDT&E, DW	CA5	3,500
	RDT&E Total			162,700
	Total			332,128

Senator DOLE. Thank you.

Dr. Cerveny, Dr. Tegnelia, in 2005 the Domestic Nuclear Detection Office (DNDO) was established within the DHS to improve the Nation's capability to detect and report unauthorized attempts to import, possess, store, develop, or transport nuclear or radiological material for use against the United States. How does DNDO coordinate its efforts with DOE and DOD, both of which have responsibilities related to nuclear detection and homeland defense against nuclear threats?

Has a division of labor been established that is workable and eliminates seams and gaps?

Dr. CERVENY. We work quite closely with the DNDO. They are part of that four-way MOU that I mentioned earlier. The DNDO transformational R&D office is the one that we work the closest with. The coordination we do with them is extremely tight in that we fund maybe one half of something and they will fund the other half of something, and we coordinate it closely and then transition the data and information back and forth as it is needed.

With the DNDO office, we have had a very close collegial relationship with them transitioning information back and forth. There has been no difficulty with us working with them.

Senator DOLE. Doctor Tegnelia?

Dr. TEGNELIA. Senator, we also have a good working relationship with DNDO. I mentioned to you this important area of working on longer-range nuclear detection devices. We do that on this joint MOU between—with DNDO as the lead, with DOE and DTRA. We share test facilities. We do joint tests together, and we work international programs together as well as in DNDO.

I have a personal interest in it because the top three people in DNDO are ex-DTRA people. The community, especially where you are concerned with things like nuclear detection and characterization, is a small community, and we share people. We share people on a continuing basis to make sure that we are coordinated.

Senator DOLE. Thank you very much.

Senator REED. Thank you very much.

If I may, I don't want to go too long, but a couple of other questions. Dr. Tegnelia, in response to Senator Dole's question about the bench, if you will, for scientists, et cetera, it underscores that one of the key allies in this effort are university research programs, basic research.

One area that I have heard is not sufficiently supported with programs is radiochemistry. I am just wondering if, in your view, that is right and, two, what are the other areas of shortage that we might think about in the future? Because without these talented scientists, this is a much more difficult problem.

Dr. TEGNELIA. First of all, the subject of radiochemistry is the key technology associated with this problem of attribution, and Dr. Cerveny might comment on this. But my sense is we are using capabilities that were built in the nuclear weapons laboratories that go back quite a ways, and building the next generation of nuclear chemists capable of being able to do these 21st century problems is extremely important to us.

We put a lot of basic research into that particular activity aimed at finding new radiochemistry techniques to reduce the time and put in modern equipment to reduce the time of analyzing these nuclear events that we have. So that is a very important area.

I keep emphasizing, and maybe I am beginning to get repetitive here on the subject of nuclear detection. The problem doesn't start if you can't find the nuclear device. So detection really is extremely important, and there has not been a lot of money that was put into innovative ideas associated with nuclear detection.

Like I mentioned in my opening statement, we do that with the DOE. But bringing the universities into this problem to come up with new ideas is also an active area of research for us. I think the people are interested in trying to do that kind of work.

Just to give you a vignette: we are relatively new in the basic research activity. This is our second year. You have helped us a lot with the research there. In our second year, when we went out with our advertisement for new ideas in combating WMD, we got 1,000 proposals back from the universities to fund this work.

So there is a demand out there. The ability to spend basic research money well in the universities is there, and I think it gives us this dual benefit of new technology as well as people introduced to the topic. So I would encourage that kind of work.

Senator REED. Let me skip to Dr. Cerveny and then ask General Reeves the same question about shortages. Dr. Cerveny?

Dr. CERVENY. The radiochemistry is in the forensics arena that we are discussing here. As the NAS study that we just recently mentioned, when Mrs. Dole mentioned it and asked me a question about it, indicates that to manage the entire system the way we have it, if there are just less than 10—somewhere between 4 and 8—Ph.D. graduates per year, we would be able to replenish the entire workforce within about 5 to 10 years.

The number of people who do this work in the laboratory are really quite small. It is not a huge number of folks who are doing this and have this kind of expertise. So it is wonderful that we have the individuals who are senior and have the significant experience that we would like to do the data dump from. But at the same time, we do need to find the replacements and get them learning how to do the same sorts of things that they do.

Is there a shortage of radiochemists? Yes and no. From the yes side, the shortage is that they don't have the experience that we need, and that is where the lacking really is from the standpoint of what I do. Now from the standpoint of some of the other components, perhaps they need them for a different reason because there really is a deficit. But for me, it is the experience that I need for them to attain, and we are working on trying to get that for them.

Senator REED. Major General Reeves, your comments about the shortages and chokepoints in terms of talented scientists?

General REEVES. We absolutely recognize the problem and share the concern. As Dr. Tegnelia alluded to, combine the aging workforce with a precipitous drop in math, science, and engineering graduates, and you have a pretty bad recipe.

We engage in a range of programs in DOD as well as in the Army to address the issue. The good news is we have seen a small uptick in the number of biotechnologists or multidisciplined biologists. But hard math, hard science, engineering as an aggregate remains problematic.

Some examples of what is going on inside the chemical and biological defense program, the Edgewood Chemical and Biological Center is engaged with eight different universities and colleges, both at the undergraduate and graduate level, on an internship basis. The Army Medical Research Institute at Fort Detrick, MD, is engaged with four different colleges and universities on the same type of program. The chem/bio defense program itself funds some interns and postdoctoral studies.

Congress actually has indirectly assisted us in something called the Veterans Reassignment Act, which allows us to rapidly bring into the Government noncompetitive people. So as we look at our veterans, we look for those who have hard science backgrounds, and we get what we call a two-for. We get someone who has not only the military background and experience and brings that operational perspective to us, but also the hard science background and then be able to apply that to the technology problems that they know are there.

Senator REED. Thank you very much, General.

Senator Dole, if you don't have any additional questions, I would ask that the witnesses be prepared perhaps to respond to written questions, if the staff would develop those questions.

I want to thank you for excellent testimony and a wonderful demonstration, and you have outlined some significant challenges. So we will need your help going forward, just as we have needed it today.

Thank you very much. The hearing is adjourned.

[Questions for the record with answers supplied follow:]

QUESTIONS SUBMITTED BY SENATOR CARL LEVIN

ANTHRAX VACCINE PROCUREMENT

1. Senator LEVIN. Major General Reeves, the Department of Defense (DOD) has been procuring a Food and Drug Administration (FDA)-approved vaccine to protect its personnel against anthrax. Last year the Department of Health and Human Services (HHS) awarded a contract to procure the anthrax vaccine for the Strategic National Stockpile, and the DOD has not awarded a new procurement contract. Is DOD committed to ensuring that its personnel continue to be vaccinated and protected against anthrax?

General REEVES. Yes, DOD is committed to ensuring that its personnel continue to be vaccinated and protected against anthrax. DOD and HHS have recently entered into an agreement for a common anthrax vaccine stockpile. Using a single U.S. Government contract, administered by HHS, we anticipate a cost avoidance of approximately $10 million annually. A single contract also ensures sufficient procurement to maintain the industrial base.

2. Senator LEVIN. Major General Reeves, how does the DOD plan to obtain additional anthrax vaccine doses for its personnel? For example, will it order them through HHS (through a consolidated stockpile), or will DOD procure additional vaccine separately?

General REEVES. The DOD will obtain anthrax vaccine through the HHS Strategic National Stockpile.

3. Senator LEVIN. Major General Reeves, what mechanism does DOD have in place to ensure that our military forces will have a reliable and adequate supply of anthrax vaccine for the next 5 years and beyond?

General REEVES. The DOD interagency agreement with the HHS/Center for Disease Control and Prevention will ensure that our military forces will have a reliable and adequate supply of FDA-approved anthrax vaccine at least for the next 5 years. This agreement meets the requirements for the Strategic National Stockpile established in Homeland Security Presidential Directive-21, "Public Health and Medical Preparedness." It also implements a single integrated anthrax vaccine stockpile management system as recommended in the Government Accountability Office Report 08–88, "Actions Needed to Avoid Repeating Past Problems with Procuring New Anthrax Vaccine and Managing the Stockpile of Licensed Vaccine". The agreement provides for a single U.S. Government contract for anthrax vaccine and results in a cost avoidance of approximately $10 million annually. The agreement also takes into consideration the need to ensure sufficient U.S. Government procurement to maintain the industrial base.

The HHS contract awarded to Emergent BioSolutions in September 2007 is for the delivery of 18.75 million doses of anthrax vaccine through fiscal year 2009. With the current 3-year expiration dating of the vaccine, this product will remain available to support DOD and other government anthrax vaccine requirements through fiscal year 2012. When the FDA approves the pending 4-year expiration dating in a previously submitted Biologics License Application amendment, this would extend vaccine availability to fiscal year 2013. It is my understanding that HHS is already preparing its contract strategy to include future deliveries beyond the already contracted 2009 date.

TRANSFORMATIONAL MEDICAL TECHNOLOGY INITIATIVE AND ALTERNATIVE APPROACHES

4. Senator LEVIN. Major General Reeves, the DOD is pursuing a program called the Transformational Medical Technology Initiative (TMTI) to provide broad spectrum protection against a variety of biological threats, including newly engineered

threats. Is the TMTI program intended to provide protection against known biological threats, such as botulinum toxin? If so, which threats are intended to be covered?

General REEVES. The TMTI program is intended to provide protection against known biological threats such as viral hemorrhagic fevers (e.g., Ebola and Marburg) and intra-cellular bacterial pathogens (e.g., Tularemia) that we have little to no existing capability to counteract. The TMTI capability will also allow us to respond rapidly to new or emerging biological threats, particularly new viruses and bacteria. TMTI is not specifically targeting known biological threats where some capability already exists, such as botulinum toxin, smallpox, and anthrax. Our core medical advanced acquisition program has, or is in the process of, developing specific vaccines or therapeutic countermeasures for these biological threats.

5. Senator LEVIN. Major General Reeves, in addition to TMTI, what other approaches is the DOD taking to address the established biological threats, such as botulinum toxin and Ebola?

General REEVES. In addition to TMTI, the other approaches the DOD takes to address established biological threats include the Chemical and Biological Defense Program's core medical science and technology (S&T), and advanced acquisition development programs and the purchase of off-the-shelf FDA-approved antibiotics. Our core medical research, development, and acquisition advanced acquisition program investigates and develops diagnostic systems, therapeutics, and vaccines to address established biological threats. This includes the FDA-licensed anthrax and smallpox vaccines and current development programs for botulinum toxin vaccine and plague vaccine. Vaccine development for equine encephalitis and ricin are ready to begin as funding becomes available. Diagnostic systems are also available based on assays developed from genomic reference materials (antigens, nucleic acids, and antibodies).

QUESTIONS SUBMITTED BY SENATOR JACK REED

GREATEST TECHNOLOGY CHALLENGE

6. Senator REED. Dr. Tegnelia, Major General Reeves, and Dr. Cerveny, you are all experts in the area of technology for combating weapons of mass destruction (WMD). If there were one technical development you most want to achieve in the next 5 years, what would it be?

Dr. TEGNELIA. Unfortunately there is no single technical development that will immediately put us in a position of considerable advantage over our adversary. The threats are diverse and our adversaries will always adjust their tactics to take advantage of our weak spots. It is therefore critical that we continue to build balanced programs in which we very carefully weigh the risks and benefits between investments in evolutionary technologies. Technologies that deliver incremental advances of our current capabilities and game-changing technologies which carry much more technical risk yet place us in a position of having a much-needed considerable advantage over our adversary. While such revolutionary technologies have been identified across the spectrum of WMD threats, they are still many decades away.

Key capabilities that we seek to develop include:

- Global situational awareness infrastructure in which the rapid fusion of intelligence data leads to decisive yet appropriate U.S. Government action within the course of hours
- Broad spectrum or platform therapeutics that can be quickly modified and manufactured (over the course of days or weeks rather than years) in sufficient quantities to respond to an emerging biological threat
- Long-range stand-off detection of WMD threats
- Long-range stand-off neutralization of WMD threats
- Rapid forensic analysis to support the attribution process

General REEVES. The one technical development we most want to achieve in the next 5 years is improving our stand-off detection technology, so that we can provide the warfighter and others with a significantly enhanced early warning capability. Our existing chemical agent stand-off technology can only detect vapor out to a limited distance. We are addressing this technological limitation through identifying and implementing new technologies, and by developing an early warning capability through a system of systems approach.

We are investigating many different technologies that can potentially improve our stand-off ability, such as active and passive Light Detection and Ranging (LIDAR) technologies and hyperspectral imaging. We are also looking at ways to maximize

the effectiveness of these technologies through enhanced signal processing. Enhanced signal processing allows the technology to better differentiate between the hazard and the atmospheric background that is present.

Dr. CERVENY. Of all the technical challenges we face, we feel our most pressing problem is significantly improving our ability to consistently, accurately, and from a distance, detect and identify shielded Highly-Enriched Uranium (HEU). We are attacking this very difficult technical problem from several directions and in conjunction with our research and development (R&D) partners in DOD, Department of Homeland Security (DHS), and the Director of National Intelligence (DNI)/S&T.

7. Senator REED. Dr. Tegnelia, Major General Reeves, and Dr. Cerveny, is there something that Congress or this subcommittee can do to help you achieve that goal?

Dr. TEGNELIA. I greatly appreciate the committee's strong support of the Defense Threat Reduction Agency (DTRA) fiscal year 2008 budget request. The additional funding provided for stand-off nuclear detection, consequence management, and WMD defeat basic research will greatly assist our efforts in these critical mission areas. In addition, the expansion of the interagency membership of the Counterproliferation Review Committee will significantly strengthen partnerships among the Combating WMD community of interest. Our fiscal year 2009 budget request will carry us down the path that you endorsed last year, and I request your support for this program.

General REEVES. Yes. The continued support of Congress and in particular, the continued cooperation between this subcommittee and the Chemical and Biological Defense Program, will be of significant help in achieving this goal.

Dr. CERVENY. All the requisite congressional actions and authorities have already been put in place to allow this work. On the serious problem of locating shielded HEU, we face many challenges, both scientific and technical. Congress has provided much needed assistance over the past few years, which has made our task more manageable. We look forward to continuing progress in these key areas.

CAPABILITY GAPS

8. Senator REED. Dr. Tegnelia, Major General Reeves, and Dr. Cerveny, in an area as dangerous as WMD, we must be careful to ensure that we do not allow critical capability gaps to develop into unacceptable vulnerabilities. To the extent you can discuss on an unclassified basis, what capability gaps have you identified, and what steps are you taking to close such gaps?

Dr. TEGNELIA. The United States Strategic Command Center for Combating WMD (SCC–WMD) is in the process of identifying capability gaps and analyzing solutions to close those gaps. Specifically, the SCC–WMD completed or is completing detailed assessments of the following CWMD missions: Offensive Operations, Threat Reduction Cooperation (TRC), Security Cooperation and Partner Activities (SCPA), National Technical Nuclear Forensics, Foreign Consequence Management (CM), WMD Defeat, and Radiological and Nuclear Stand-off Detection.

Based on these assessments, several cross-cutting capability gaps were identified and are being addressed. The most critical of these involve the limited production and availability of actionable intelligence on WMD proliferation networks and global WMD events; the duplication of efforts and unnecessary expenditure of time, resources, and money caused by the lack of coordination between national agencies and the lack of clear guidance on WMD-specific goals, policies, or strategies; and insufficient capability to predict, model, and execute operations resulting in little to no collateral effects.

Some steps taken to close these gaps include the development of the Situational Awareness CWMD Information Portal and the Interagency CWMD Database of Responsibilities, Authorities, and Capabilities to increase coordination; the completion of a full capabilities-based assessment on the CWMD Offensive Operations mission area which lead to the development of a WMD Defeat Initial Capabilities Document (ICD) and a Radiological/Nuclear Stand-off Detection ICD; and the completion of a needs assessment for SCPA and TRC. The SCC–WMD is also leading an assessment of the CM mitigation requirement of the Geographical Combatant Commanders (GCC). This assessment will address requirements necessary to mitigate an overseas Chemical, Biological, Radiological, and Nuclear (CBRN) event, and identify the assets that GCCs could offer in a Foreign CM situation. Finally, the SCC–WMD completed a detailed capabilities-based assessment of tasks, capabilities, and solutions for conducting National Technical Nuclear Forensics. The DTRA worked with SCC–WMD to develop forensic tactics, techniques, and procedures, which will be validated in upcoming exercises. Additionally, SCC–WMD and DTRA work continu-

ously with other members of the broader CWMD enterprise to be responsive to warfighter operational needs.

General REEVES. The Chemical and Biological Defense Program has 43 programs of record to address capability gaps across the spectrum of needed chemical and biological defense capabilities. Some of these capability gaps present us with a more difficult challenge than others. Difficult challenges include technologies for standoff detection. They also include decontamination, detection, and protection capabilities across the entire spectrum of threat agents.

The steps we are taking to meet these challenges include determining the ability of existing government and commercial off-the-shelf capabilities to rapidly address these gaps, either as an individual technology or within a system of systems approach. We have identified our challenges in these areas to academia, industry, and the S&T base and they have helped us to identify emerging technologies that can contribute to closing these gaps.

Dr. CERVENY. In fiscal year 2006, my office embarked on a considerable effort to develop strategic plans to identify the critical capability/technology gaps of the nonproliferation community, drawing inputs from the R&D and user communities. With these capability gaps identified, we generated long-term technical roadmaps to focus our R&D efforts to meet current and anticipated future capability needs, including the shielded HEU problem discussed previously.

INTELLIGENCE COMMUNITY INTERACTION

9. Senator REED. Dr. Tegnelia, Major General Reeves, and Dr. Cerveny, the Intelligence Community (IC) is a critical partner in our overall efforts to reduce and eliminate threats from WMD, as you noted in your testimony. How are your research and technology development programs informed by threat analyses of the IC?

Dr. TEGNELIA. DTRA is acutely aware that the WMD threat is constantly evolving and that timely and accurate intelligence is fundamental to the application of sound Research, Development, Test and Evaluation (RDT&E) programs. Across the Combating WMD mission, DTRA works closely through established channels with the IC to improve situational awareness of current and anticipated threats, and to provide technical information that will support the IC in its mission. We also collaborate with the IC on special projects of mutual interest and conduct periodic S&T exchanges to share the latest information on the threat. Lastly, our RDT&E programs are based largely upon threat assessments from the IC, as well as combatant commanders' evaluation of shortfalls in operational capabilities and the opportunities provided by the promise of maturing technologies.

General REEVES. Our research and technology development programs are informed of threat analysis via the IC through both formal and informal means. The formal means includes IC participation in developing, and review of, program documentation such as the System Threat Assessment Report and Joint Threat Test Support Package. These documents feed the requirements development process, product development, and test and evaluation process for each program. Other formal means include incorporating into our program planning and execution information contained in threat documents such as the Chemical, Biological, Radiological and Nuclear Capstone Threat Assessment developed by the Defense Intelligence Agency (DIA). Additional means of providing programs up-to-date threat information includes liaison between the Joint Program Executive Office for Chemical and Biological Defense and the IC. The Joint Program Executive Office for Chemical and Biological Defense has a full time senior staff intelligence officer to coordinate with the IC and to keep the entire command informed regarding the existing and emerging chemical, biological, radiological, and nuclear threat.

Dr. CERVENY. The IC provides information critical to our technology development and requirements roadmaps. Additionally, our Nonproliferation R&D program managers and our laboratory researchers hold appropriate security clearances and are well-informed of threat analyses from the IC. We use the results of the threat analyses to guide and steer our investments in R&D to ultimately develop sensors to meet the present and future nonproliferation threat. As I noted in my testimony, there is a four-way Memorandum of Understanding (MOU) between Domestic Nuclear Defense Organization (DNDO)–National Nuclear Security Agency (NNSA)–DTRA–Director of National Intelligence (Science and Technology) identifying requirements and methods for collaboration and cooperation relating to nuclear detection technology development amongst the parties of the MOU.

10. Senator REED. Dr. Tegnelia, Major General Reeves, and Dr. Cerveny, how do you interface with the IC in general, for example, by providing some of the expertise of your organizations to support their assessments and analyses?

Dr. TEGNELIA. The DTRA has always sought to support the IC with our technical expertise, but we need to do more. Such interaction between the Nation's technical base and IC is especially important in the assessment of WMD threats, which by nature are both technically complex, and conjoined with potential courses of action to deter, reduce, or defeat those threats.

Historically, the IC has engaged DTRA with questions related to nuclear weapon effects (as an example, to support assessments of threats from electromagnetic pulse (EMP)) or vulnerabilities of foreign military systems). However, the DTRA relationship with the IC has broadened and deepened as the Combating WMD mission has matured. Perhaps the best example of this new level of interaction is our full-time participation in the DIA's Underground Facility Analysis Center (UFAC). DTRA engineers and scientists (which include members from our industry performer base) are embedded in the UFAC, providing engineering assessments about the construction, operation, and potential vulnerabilities of hardened and deeply buried targets. This close coupling not only improves the intelligence end product, but provides unique and timely insight to support DTRA research in weapon and intelligence, surveillance, and reconnaissance (ISR) concepts.

The challenge ahead for DTRA is in providing such support across the entire WMD threat spectrum. To this end, we have launched a project with DIA to establish the "Counter WMD Analysis Cell." The objective of this cell is to better integrate DOD and its interagency Combating WMD partners with the IC in the collaborative analysis of long-term, complex WMD threats.

General REEVES. We routinely interface with a number of organizations within the IC, to include various offices within the DIA, Central Intelligence Agency, National Security Agency, the National Ground Intelligence Center, and the Armed Forces Medical Intelligence Center. Our coordination and collaboration with the IC includes informal information exchanges, requests for briefings, quick reaction responses to time-sensitive issues, attending scientific and/or intelligence related conferences and exhibitions, or formal requests for threat information via the Community On-Line Intelligence System for End Users and Managers. A specific example is the scientific and technical intelligence conferences hosted by the National Ground Intelligence Center on our behalf. The IC is consistently responsive to the Joint Program Executive Office's needs, and we enjoy an excellent collaborative working relationship.

Dr. CERVENY. In general, NNSA's Nonproliferation R&D Office interfaces with the IC during R&D program reviews, proposal evaluations, and research proposal selection boards to coordinate and deconflict R&D thrust areas. Our technical program managers and lab advisors also serve as advisors to IC organizations as requested/needed, above and beyond the general close collaboration/coordination of our programs. Often, our Nonproliferation R&D serves dual function as a technological foundation for the IC to develop systems.

CHALLENGE OF STAND-OFF DETECTION

11. Senator REED. Dr. Tegnelia, Major General Reeves, and Dr. Cerveny, it seems that for all areas of combating WMD it would be extremely useful to be able to detect weapons or materials at stand-off distances. What do you see as the current limits for stand-off detection, and what do you think we can realistically achieve in the next decade?

Dr. TEGNELIA. Current fielded technology employs passive detectors that measure gamma and neutron radiation. Hand-held systems can detect a significant mass of fissile material (HEU or plutonium) at ranges of a few meters. Large vehicle or aircraft mounted systems can detect at ranges of 20 to 30 meters, with sufficient monitoring time. Unfortunately, the use of shielding and other countermeasures can greatly reduce detection ranges. Few of these specialized detection systems currently exist in the DOD, and most are employed by special units that are tasked with interdiction missions. Our research program emphasizes active detection techniques that can greatly enhance detectable signatures from fissile material, even in shielded configurations, as well as meet operational requirements of our warfighters including ease of deployability and sustainability, small physical footprint, long range, and persistent surveillance.

The system with highest technological maturity is the stand-off photo-fission effort. This program has been under extensive development, test, and evaluation over the last several years, with a planned field demonstration this fall. A detection

range of 100–200 meters will be shown. Further enhancements to this technology may allow detection ranges of several hundred meters. The system employs a very high energy x-ray beam to interrogate an area, and cause fission in HEU or plutonium which enables its detection.

We are also pursuing interrogation systems employing protons, muons, and gamma rays. These alternative technologies have significant merits including ranges that could exceed a kilometer, but are presently only in the early stages of R&D. Within the next decade, and with sufficient resources, initial operational capabilities based on photo-fission systems should be a reality, and several alternative technologies should be matured to the point where early operational assessments are possible.

General REEVES. Our current limit for chemical and biological stand-off detection is the maturity of the technology available. We do think that some new technologies will mature within the next 5 to 10 years (such as active and passive LIDAR technologies and hyperspectral imaging technologies), and that those technologies, combined with the system of systems approach may provide us with a means to provide early warning of chemical and biological hazards delivered in any state (aerosol, liquid, or vapor) out to ranges of 5 kilometers and beyond within the next decade.

Dr. CERVENY. The issue of stand-off detection is a complex one and is approached differently by our R&D partners. For nonproliferation applications, we are certainly interested in increasing stand-off detection capabilities. Using passive detection, current limits of detection for unshielded nuclear material are generally in the range of several meters. Using advanced detection technologies like direct radiation imaging, detection can be extended to perhaps several 10s of meters in the most favorable of circumstances. For shielded nuclear material, which may prevent the emission of radiation, passive detection is much more challenging and may only be possible within several meters from the source, and perhaps not successfully at all. Active interrogation (using external sources of radiation to increase the radiation emission from nuclear materials) can increase detection distances and detection confidence for both shielded and unshielded material.

UNFUNDED PRIORITIES

12. Senator REED. General Reeves, at the hearing you mentioned that you could supply a complete list of your underfunded priorities, if requested. Please supply that list.

General REEVES. The U.S. Army has a list of underfunded priorities and is provided by the Special Assistant (Chemical and Biological Defense and Chemical Demilitarization Programs).

CBDP PRIORITY	UNFUNDED REQUIREMENTS	APPROPRIATION	P-1 ITEM OR R-2a PROJECT	FY09 (in 000s)
001	Joint Biological Standoff Detection System (JBSDS)	Procurement, DW	JC0250	28,000
002	Joint Biological Point Detection System (JBPDS)	Procurement, DW	JC0100	27,328
003	Joint Service General Purpose Mask (JSGPM)	Procurement, DW	JI0003	18,300
004	CBRN Small Project Acquisition Program (C-SPA) Modernization and COTS/ GOTS Refreshment	Procurement, DW	JS0004	12,400
005	Joint Service Personnel Decontamination System (JSPDS)	Procurement, DW	JD0055	3,600
006	Collective Protection System Backfit (CPS Backfit)	Procurement, DW	JN0014	5,600
007	Individual Protection Program (IPP)	Procurement, DW	JS0500	24,200
008	JSLIST Industrial Base	Procurement, DW	MA0400	50,000
	Procurement Total			169,428
001	Automated Sample Preparation for Biological Identification			
	Advanced Technology Development	RDT&E, DW	CB3	1,400
	Advanced Component Development & Prototypes	RDT&E, DW	MB4	3,500
002	NTA Detection/ Chemical Point Detection			
	Toxicology and Pharmicokinetic Studies	RDT&E, DW	CB2	3,000
	Provide TRL Six (6) capability	RDT&E, DW	CB3	11,700

	Handheld Detection of Liquids and Solids	RDT&E, DW	CA4	11,900
003	NTA T&E Facility Upgrades	RDT&E, DW	TE4	6,000
004	CB Distributed Early Warning System (CBDEWS)			
	Small Sensor Platform Development	RDT&E, DW	CB2	6,500
	LIDAR DISC/ DIAL	RDT&E, DW	CB3	10,000
	Hyper-Spectral/ Imaging Spectroscopy Acceleration	RDT&E, DW	CB3	5,000
005	CB Distributed Early Warning System (CBDEWS)			
	Active/ Passive Sensor Optimization Algorithm Development	RDT&E, DW	CA4	8,000
	Support Operational Demonstration	RDT&E, DW	CA5	1,800
006	Modular Mobile Lab	RDT&E, DW	CM5	14,000
007	National Bio-Monitoring/ Medical Surveillance	RDT&E, DW	MB5	13,500
008	All Hazards System-of-Systems Decontamination - S&T			
	Enabling Sciences	RDT&E, DW	CB2	4,500
	Energetic and Kinetic	RDT&E, DW	CB2	2,000
	Reactive Systems	RDT&E, DW	CB2	4,500
	Demonstrate Dual Use Capabilities	RDT&E, DW	CB3	12,000
	Traditional Approaches	RDT&E, DW	CB3	4,000
	Smart Systems	RDT&E, DW	CB3	3,000
	Self-Detoxifying Systems	RDT&E, DW	CB3	3,000
	Barrier Material	RDT&E, DW	CB3	4,000
	Enzymatic Approaches	RDT&E, DW	CB3	3,500
	Technology Readiness Assessment (TRA)	RDT&E, DW	DE4	4,000
009	Information Systems Enhancements (cognitive thinking and decision support)	RDT&E, DW	IS4	12,600
010	CBDP Integration into MDAP	RDT&E, DW	CA4	5,800
011	Advanced Bio-Identification Technology Upgrade to Joint Portal Shield	RDT&E, DW	CA5	3,500
	RDT&E Total			162,700
	Total			332,128

NUCLEAR CONSEQUENCE MANAGEMENT

13. Senator REED. Dr. Tegnelia and Dr. Cerveny, you are both experts in nuclear technology. The nightmare scenario that is most frightening to many of us is a terrorist group acquiring a nuclear weapon and detonating it in an American city. How do you believe we can best prevent such a catastrophe, and how do you believe we can best prepare to manage the consequences of a nuclear detonation in an American city?

Dr. TEGNELIA. Real time, actionable intelligence that identifies pathways and sources of terrorist nuclear proliferation is vital. In addition, we must continue to improve detection capabilities so that they are more effective at longer ranges and against shielded material. The development of advanced forensics capabilities will contribute to deterrence, assist in preventing follow-on attacks from the same source, and provide critical information upon which the national leadership may take appropriate action. In addition, we need to vigorously exercise these capabilities.

Dr. CERVENY. Terrorist detonation of a nuclear weapon is indeed a nightmare scenario and preventing it is a priority. First and foremost, preventing it means keeping the materials, technology, and expertise needed for a nuclear weapon from falling into the hands of terrorists. Without the material (HEU or plutonium) there can be no weapon. For that reason, NNSA is focused first on securing, removing, and downblending fissile materials all around the world. We are also working to detect and deter illicit shipments of nuclear material. NNSA works with various other U.S. Government agencies, including the DOD, the IC, the DHS, the State Department, the Department of Transportation, the Nuclear Regulatory Commission, and the De-

partment of Justice, to accomplish many of these tasks. And we are working to strengthen the capabilities of other countries to do similar work, because the U.S. cannot do this task alone. The Nonproliferation R&D mission space does not include consequence management; therefore, I defer to my interagency colleagues to address consequence management.

14. Senator REED. Dr. Tegnelia and Dr. Cerveny, what are your organizations doing both to prevent and prepare for such a catastrophe?

Dr. TEGNELIA. The DTRA provides technical support to the IC to assist with the identification of potential proliferation pathways and sources. In coordination with our interagency partners, DTRA has the responsibility for executing the DOD portion of the nuclear defense mission, including the development of stand-off detection capabilities that meet DOD operational needs, and, as part of the National Technical Nuclear Forensics (NTNF) program, executes programs designed to provide high confidence technical conclusions about an attack to support attribution, facilitate government action, and stop subsequent attacks.

DTRA also plays a key role in the exercising of these capabilities with the combatant commands (COCOMs) and our interagency partners. Specifically, DTRA directly supports COCOMs with a number of training events on an annual basis. The following are highlights of recent exercises focusing on nuclear and radiological incidents:

- Dingo King 2005: Exercise Dingo King 05 (DK 05) was a DTRA sponsored nuclear weapon accident exercise conducted from 22–26 August 2005 in Kings Bay, Georgia, designed to exercise Federal, State, and local emergency response and consequence management (CM) actions. The response included extensive DOD and Department of Energy (DOE) participation; local emergency responders; County and State government agencies; field involvement from other Federal agencies; and national play at higher level headquarters at U.S. Northern Command and the National Capitol Region.
- 'Ā Kele 2006: The 'Ā Kele Project was a State of Hawaii DOD-led and Defense DTRA-supported series of events designed to explore State and on-island civil and military response to the detonation of an improvised nuclear device (IND). The project, conducted from 15–16 August 2006, in Honolulu, HI, included a Command Post Exercise and three imbedded Field Training Exercise vignettes. Additionally 'Ā Kele included a series of training sessions for participants and a Tabletop Exercise/Senior Leaders Seminar designed to provide key leaders with a challenging forum for discussion of key issues related to the response and recovery process required following an IND event in Honolulu.
- National Level Exercise 1–07 (NLE 1–07) Vigiliant Shield 2007 (VS07) Nuclear Weapons Accident (NUWAX) Venue: The VS07 NUWAX Venue was sponsored by DTRA and was independently controlled and assessed at Davis-Monthan Air Force Base (DMAFB) in Tucson, AZ. Held in December 2006, the VS07 NUWAX Venue was the first NUWAX exercise to fully evaluate the response procedures detailed in the National Response Plan and the updated Nuclear Weapon Accident Response Procedures manual. It was also the first NUWAX exercise to integrate a Joint Field Office into incident response operations. As a result, many practical lessons were learned regarding incident response and interagency coordination.
- DTRA Support to U.S. Pacific Command (PACOM) in preparation for TOPOFF IV: DTRA provided assistance to the PACOM staff, its components, and other agencies in their preparations for TOPOFF IV, one venue being a radiological dispersal device event in Guam. TOPOFF IV involved more than 200 domestic and international organizations, ranging from governmental agencies at all levels to private industry and non-profit organizations. The exercise took place in three American cities as well as elsewhere in North America, in a U.S. territory, in Europe, and in the Pacific region. Lessons learned from TOPOFF IV have applications for response and recovery to major natural disasters.

At each of the above exercises, DTRA deployed Consequence Management Assessment Teams (CMATs) to the affected COCOM as well as augmented the Joint Staff Crisis Action Team in the National Military Command Center. DTRA also provided 24/7 reachback support for modeling and additional subject matter expertise. DTRA also maintains awareness of, participates in, and is a funding advocate for Advanced Concept Technology Demonstrations.

Dr. CERVENY. As mentioned, NNSA is focused first on securing, removing, and downblending fissile materials all around the world. Within my own office, we are

working hard to develop the technologies, tools, and techniques needed to detect the production and movement of nuclear materials. This effort includes advancing the state-of-the-art-for-detection technologies. We also contribute to developing post-detonation nuclear forensics capabilities in support of WMD attribution, in the event that our efforts at prevention fail. A major goal of our nuclear forensics program is to transition Cold War capabilities and methodologies to meet contemporary challenges. More specifically, we fund prioritized long-term investments, integrating capabilities and expertise at national laboratories, academia, and private industry with the goal of providing technology for prevention and preparation. Our focus is to develop long-term R&D programs that provide the technical means to detect the production and acquisition of special nuclear materials, nuclear material movement, nuclear detonation detection, and post-detonation nuclear forensics. In addition to strengthening prevention efforts, detection technologies, and interdiction programs, our efforts support NNSA's Office of Emergency Operations and other response agencies of the federal government (NNSA/DOE offices, DOD, DHS, FBI, FEMA, DTRA, and others) tasked with the massive response needed in the event of such a devastating catastrophe.

15. Senator REED. Dr. Tegnelia and Dr. Cerveny, how well do you think our Government is doing to prevent and to prepare for such an attack?

Dr. TEGNELIA. The DOD has invested heavily in technologies that should continue to improve our capability to interdict and render safe a nuclear device and, therefore, prevent it from detonating inside the United States. The National Technical Nuclear Forensics program is a critical component in the effort to dissuade our enemies from utilizing a nuclear device against us. Knowledge that we will be able to trace a device back to its source and rapidly strike back is a powerful tool in our deterrence arsenal.

DTRA believes there has been substantial progress in preparing to meet such an attack. The National Guard has been particularly aggressive in developing capability to deal with the aftermath of a WMD attack. It has developed and fielded 57 full-time WMD Civil Support Teams, which are supported by the 24/7 DTRA Reachback capability. Additionally, the Guard is developing Chemical, Biological, Radiological, Nuclear, and High Yield Explosives (CBRNE) Enhanced Response Force Packages (CERFP) that have the ability to perform search and rescue in a contaminated environment, decontamination operations, and medical triage and initial treatment. We understand that there are 12 CERFPs currently in the Guard force with an additional 5 authorized and funded by Congress.

DOD has also identified the requirement for brigade-and-larger-sized CBRNE Consequence Management Response Forces that, upon activation, will consist of both Active and Reserve units. The response and effectiveness of these Guard, Reserve, and Active Forces will depend upon the magnitude and number of WMD attacks the Nation faces.

Additionally, through its exercise programs, the U.S. Government is better prepared to face the specter of a nuclear attack.

Dr. CERVENY. I feel that the United States is making progress in integrating national expertise, infrastructure, and capabilities to meet the challenge.

Both prevention of and preparation for a nuclear attack requires the collective efforts of multiple governmental agencies, leveraging investments to develop and maintain national capabilities. Since September 11, the U.S. Government has been developing methodologies and has been defining responsibilities for all participants. Agreements such as the four-way radiation detection document I mentioned previously are good examples of the mechanisms the government uses to prevent and prepare for such an attack.

NUCLEAR DETECTION RESEARCH COORDINATION

16. Senator REED. Dr. Tegnelia and Dr. Cerveny, both the NNSA and the DTRA are conducting nuclear detection technology research. How is this work coordinated between your agencies, including the DTRA long-range stand-off photo-fission work and the Germanium Spectrometer?

Dr. TEGNELIA. The interagency research portfolio and its coordinated investment strategy are summarized in the "DHS Joint Report on Research and Development Investment Strategy for Radiological and Nuclear Detection" Report to Congress (October 2007).

DTRA works closely and directly with NNSA's Office of Nonproliferation Research and Engineering (NA–22), as well as the Domestic Nuclear Detection Office (DNDO) to coordinate and review research efforts. Details of this coordination were estab-

lished in a formal MOU between the interagency, dated June 2007. Interagency coordination meetings occur regularly throughout the year to inform and communicate each agency's research portfolio, de-conflict funded research activities, and identify areas where mutual support can expedite research objectives. Workshops are planned and organized that address technical areas of mutual interest. A large interagency and national laboratory workshop was held last October specifically to address active interrogation technologies, to include the stand-off photo-fission work, and to develop a coordinated roadmap for these large scale efforts. The interagency also mutually participate in research proposal development, research proposal reviews, and funded research program reviews. Where joint investment is made by DNDO and DOE, such as in the germanium spectrometer and other advanced detectors, we work to ensure that efforts are complementary rather than redundant.

Dr. CERVENY. As I mentioned in my testimony, NNSA and DTRA (and our predecessor organizations), have had an ongoing collaboration of efforts in nuclear detection technology research for nearly 60 years. There are numerous examples of cooperative R&D activities over this long partnership, and in fact several ongoing projects arc either co-supported or leveraging both organizations' investment. The two technologies you've mentioned are excellent examples. Portable accelerator development and specialized sensor development for active interrogation via photo-fission are longstanding investment areas by both organizations. NNSA has provided support for the basic technical development, and DTRA is supporting development of the hardware necessary to deploy such capabilities on small mobile platforms for field use. There are several current High Purity Germanium (HPGe) detector development efforts ongoing and of interest to both organizations. By far, the most visible effort consists of the design and fabrication of a large array of very sizable HPGe detectors in a detection system designed for airborne platform pods. This system is being designed for long operation times in harsh environments and would be very valuable where operations offer limited time-on-target opportunities. Various organizations within DOD, including DTRA and several COCOMs, are engaged in taking this capability to a field demonstration in the near future.

17. Senator REED. Dr. Tegnelia and Dr. Cerveny, what are the challenges associated with detecting the most dangerous materials, namely, HEU and plutonium?

Dr. TEGNELIA. Special nuclear materials, i.e. HEU and plutonium, are of course radioactive and are the key ingredients of nuclear explosives. Detection of these materials is dependent on our ability to detect the radiation that they emit, usually gamma and neutron radiation. Unfortunately, these emissions are relatively weak, and with some forethought can be effectively shielded. HEU in particular is very difficult to detect. In metallic form it emits very few neutrons, and has very few gamma ray emissions at detectable energies. Some of the difficulties associated with HEU detection were raised in the April 2008 issue of Scientific American. Detection is further limited by the rapid decrease in detectable radiation as distance from the material increases. Our research efforts are focused on overcoming these inherent challenges, with emphasis on active techniques that can greatly increase the signatures emitted by HEU and plutonium, even when shielded and at significant standoff ranges. We are also pursuing passive detection technologies that more effectively detect the radiations emitted by these materials, and can distinguish threats from background radiation.

Dr. CERVENY. Since both HEU and plutonium are radioactive special nuclear materials, they are detectable and identifiable by their unique radiation emission signatures. Detection techniques rely on the radioactive emissions of both neutrons and gamma rays from these materials. Not only is the presence of these emission particles important, but their energy content is as well. The difficulty resides in the low rates and low energies of radioactive emission for both HEU and plutonium, but especially for HEU. In many cases, the low emission rates dictate very long detection times. In addition to low emission rates, detection is made difficult by the preponderance of radioactive materials in the natural environment (background), which, in some instances, presents a radiation signature very similar to the threat materials. In addition, articles in the normal stream of commerce may contain legitimate and harmless radioactive materials. These materials are often referred to as Naturally Occurring Radioactive Materials (NORM). Examples include ceramic building tile, bananas, kitty litter, et cetera. At radiation portal installations, these NORM sources often cause false alarms. Finally, the radiation signatures from threat materials can be attenuated or "shielded" from detection by barriers between the threat source and the detector. High density materials, such as lead, are very effective gamma ray barriers, while low density materials such as polyethylene are effective at diminishing neutron emission. Therefore, a determined adversary has options to conceal the threat. Effective detection efforts must overcome these chal-

lenges to provide both a high confidence and a high probability of material interdiction capability. The NNSA, along with its partner agencies including DTRA and DNDO, is working on a broad spectrum of novel detection technologies that will provide continual improvements in our national capability to detect such threats.

MASSIVE ORDNANCE PENETRATOR

18. Senator REED. Dr. Tegnelia, the Massive Ordnance Penetrator (MOP) is a research project to develop and test an air-dropped weapon to defeat hard targets. Additional testing on the MOP is needed before operational integration commences, but I understand that there is not enough funding in the fiscal year 2009 budget request to complete the MOP testing. What additional testing should be completed before integrating the MOP on the B–2?

Dr. TEGNELIA. Congressional budget increases in fiscal year 2007 and fiscal year 2008 for the Air Force already have been used to start critical long lead time MOP integration tasks with the B–2 bomber. No additional DTRA funding is required in fiscal year 2009 to support testing in advance of MOP operational integration with the B–2 bomber. The DTRA fiscal year 2009 budget request includes approximately $1.2 million to continue development of the MOP, consistent with Air Force fiscal year 2009 budget request and plans. The DTRA fiscal year 2009 funding would be used to conduct scaled fragmentation and penetration experiments to improve the accuracy of MOP phenomenology modeling within DTRA's Integrated Munitions Effects Assessment (IMEA) tool that is used by the COCOMs for weaponeering of Hard and Deeply Buried Targets (HDBTs). DTRA is currently transitioning the MOP technology development effort to the Air Force, and is not programming DTRA funding in fiscal year 2010 and beyond for the continuation of such work. However, if the Air Force MOP/B–2 integration program is accelerated, DTRA may support future testing to measure MOP lethality against representative HDBTs.

19. Senator REED. Dr. Tegnelia, what would the additional MOP testing cost in fiscal year 2009?

Dr. TEGNELIA. Since additional DTRA MOP testing is not required in fiscal year 2009, no additional funds are required.

RADIATION HARDENED ELECTRONICS

20. Senator REED. Dr. Tegnelia, from its predecessor agency, the Defense Nuclear Agency, DTRA has the DOD lead for understanding radiation effects on electronics. These effects are of great importance to various space systems, including those systems that have to provide survivable protected communications. What is your assessment of the health of the DOD ability to keep pace with industry in developing radiation hardened electronics?

Dr. TEGNELIA. The health of the DOD's radiation hardened microelectronics capability is measured by the available technology to meet user needs for strategic space or missiles systems on the DOD Radiation Hardened Oversight Council (RHOC) roadmap. The DOD approach for radiation hardened microelectronics is to partner with industry for access to high volume and near-leading-edge products that are less expensive and have proven performance. This approach enables the DOD to leverage industry's development costs and efforts.

Presently, the commercial semiconductor industry has placed unhardened 65nm technology into high production and is advancing toward having an unhardened 45nm technology production capability by 2009. The current state of the DOD radiation hardened microelectronics is at 150nm and was developed under the now completed $278 million Accelerated Technology Program managed by DTRA. The 150nm technology will meet DOD requirements through 2012 at which time systems on the DOD RHOC roadmap begin to require 90nm radiation hardened technology.

The DOD is in the early stages of demonstrating the application of 90nm radiation hardened technology that would be produced in commercial high-volume foundries. However, in order to provide flight qualified 90nm technology, additional investments will be required in 2010 and 2011 to keep pace with the RHOC roadmap requirements beyond 2012.

[Whereupon, at 3:52 p.m., the subcommittee adjourned.]

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